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The Effects of Intensity Level and Expertise on Attentional Focus During Exercise

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THE EFFECTS OF INTENSITY LEVEL AND EXPERTISE ON ATTENTIONAL FOCUS DURING EXERCISE

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Abstract

An important goal of exercise psychology is to identify factors that influence exercise adherence. More than half of Americans do not get the physical activity that doctors recommend for maintaining or improving a healthy lifestyle. Attentional focus during exercise has been identified as one casual factor with regard to exercise adherence. Attentional focus has traditionally been defined as associative or dissociative (Morgan & Pollock, 1977). Association implies that an exerciser's attention is focused on how his or her body is reacting to the exercise (such as sweating, muscle soreness, and breathing) or on things such as pace and split-times. Dissociation implies that one's focus is placed on things that are unrelated to the exercise, such as daydreaming, listening to music, or focusing on the environment. The purpose of the current study was to determine how both the Stages of Change model and the intensity level of the exercise bout affect attentional focus. A new six-category measure of attentional focus was used. A total of 145 undergraduate psychology students were divided into differing levels of expertise based on the Stages of Change model and assigned to run at a moderate and very hard intensity on two separate days; attentional focus was measured following each bout. All but one stage of change focused on bodily sensations significantly more at the very hard intensity; the pre-contemplation/contemplation stage focused on bodily sensations less at the very hard intensity. Regardless of level of expertise, focus on bodily sensations, self-talk, and task-relevant external cues significantly increased and focus on task-irrelevant thoughts and external distractions significantly decreased from the moderate to very hard intensity. Participants reported significantly greater perceived exertion, greater pain, and less enjoyment at the very hard compared to the moderate intensity. Implications for these findings are discussed.

Introduction

It is well known that extensive physical and psychological benefits results from exercise. Regular physical activity builds muscle, which in turn burns fat and increases strength, improves respiration and blood pressure, and prolongs life (CDC, 2003). It is also well known that many Americans are not as physically active as they should be; over 50% of American adults do not exercise to the point of gaining health benefits, and 25% are not physically active at all (CDC, 2003). Much of the research in exercise psychology has focused on how to influence people not only to begin an exercise routine but to adhere to it. Attentional focus has been of interest in research concerning exercise adherence because of its effects on adherence and intensity. People pay attention to different things during exercise, be it their heart rate, the pace of the exercise, or music. Two factors that may influence what people attend to while exercising are the intensity level of the exercise and the level of expertise of the exerciser. The literature suggests that high exercise intensities force the focus of attention on the physiological symptoms elicited by the exercise and that people more accustomed to exercise (i.e., athletes) can control their focus of attention more readily than people who do not exercise regularly. Yet, no studies have examined the interaction between exercise intensity and experience levels on attentional focus. The current study's aim is to examine differences between participants at differing expertise levels with regard to attentional focus during both a moderate and very hard exercise bout.

Attentional focus

Attention can be defined as the allocation of cognitive resources. Attentional focus refers to the cognitive strategy used while exercising. Traditionally, it has been broken down into two dimensions: association and dissociation (Morgan & Pollock, 1977). As the research on attentional focus progressed, some researchers raised concerns about these dimensions.

There have been two major concerns with the terminology of "association" and "dissociation." First, the term "dissociation" has a pathological connotation (Stevinson & Biddle, 1999). This is an obvious problem considering its purpose in describing a cognitive strategy that is unrelated to pathological dissociation. A second concern is that runners' cognitions are too complex to dichotomize simply (Stevinson & Biddle, 1998).

Stevinson and Biddle (1998) developed a 2X2 model of attentional focus based on task relevance and direction of attention (i.e. internal/external focus) (Table 1). Internal task-relevance includes internal associations that are related to the exercise, such as focusing on breathing, heart rate, or fatigue. External task-relevance refers to focusing on things that are related to the exercise but are external to the person, such as paying attention to distance markers, the route, or split times. When an exerciser's attention is focused on things other than the exercise, attentional focus is labeled as task-irrelevant. Internal task-irrelevance means that the exerciser is daydreaming, planning his week, or solving math problems in his head. External task-irrelevance includes watching television, listening to music, or focusing on the surrounding environment. Little research has been conducted using this 2X2 model. Few studies aside from Stevinson and Biddle (1998) have recognized that attentional focus involves more than a single dimension (Connolly & Janelle, 2003; Couture, Jerome, & Tihanyi, 1999).

Table 1

Stevinson and Biddle's 2X2 Model of Attentional Focus

	Internal	External
Task-relevant	fatigue, muscle soreness, breathing, perspiration, cramp, nausea, blisters	conditions, route, strategy, drink stations, split times, distance markers
Task-irrelevant	daydreams, fantasies, math, puzzles, imagining music, poetry, philosophy	scenery, environment, spectators, other runners, fancy dress, chatting

The current study used a new measure of attention focus (the Measure of Attentional Focus; MAF) that was designed for this experiment (Table 2). The MAF used here was based on Stevinson and Biddle's (1998) measure of attentional focus. Please refer to the methods section of the current paper for more specific information on the MAF.

Table 2

Measure of attentional focus (MAF)

	Internal			External
Task-relevant	Bodily sensations	Task-relevant thoughts	Self-talk	Task-relevant external cues
Task-irrelevant	Task-irrelevant thoughts			External distractions

Factors associated with exercise adherence

Adherence can be defined by three dimensions: performance/intensity, duration/distance, and frequency. A runner's attentional strategy has the ability to influence a number of important elements that are involved in the task. Research has shown that, depending on the type of cognitive strategy employed, performance and endurance can increase, perceived exertion and fatigue can decrease, and enjoyment or affect can change (Connolly & Janelle, 2003; Couture, Jerome & Tihanyi, 1999; Fillingim & Fine, 1986; Masters & Lambert, 1989; Morgan, Horstman, Cymerman, & Stokes, 1983; Nethery, 2002; Scott, Scott, Bedic, & Dowd, 1999). The duration of the exercise bout can also feel shorter, allowing a person to run for longer and not succumb to boredom or fatigue (Pennebaker & Lightner, 1980).

Presently, the literature on attentional focus is inconsistent with regard to which cognitive strategy should be used to enhance performance. Masters and Ogles (1998) conducted a literature review and concluded that, overall, association (task-relevant focus) has been shown to lead to faster performance and dissociation (task-irrelevant focus) leads to lower exertion ratings and better endurance; however, other studies such as Okwumabua, Meyers, Schleser, and Cooke (1983) have shown that dissociation leads to faster performance times.

Findings may differ according to the level of expertise of the samples. Brewer, Van Raalte, and Linder (1996) suggest that the amount of experience that a person has with a task may influence what type of cognitive strategy works best to enhance performance. The authors explain that this could be the reason why previous research has shown that experienced athletes benefit from association and inexperienced athletes benefit from dissociation. They also note that if negative emotions are evoked by the task, attention may be directed toward the resulting distress cues. If this is the case, then an associative focus would clearly be disadvantageous, and dissociation would be more beneficial. Brewer et al. (1996) suggested that the more training one has, the more likely it is that an associative focus will enhance performance. If researchers can determine which cognitive strategy works best for individuals, perceptions of pain may decrease, which might allow for an increase in endurance.

One such study assigned differing cognitive strategies to its sample to examine adherence rates (Martin et al., 1984). Martin et al. (1984) tested 16 healthy sedentary adults to see whether or not they could benefit from being assigned an attentional focus strategy during exercise and examined adherence rates in three and six month follow-ups. The participants were given written and verbal instructions for their assigned cognitive strategy. Also, they were given personal feedback by a trainer while walking or running, and were told to devise flexible distance goals each day. The participants were randomly assigned to either an association (task-relevant focus) or dissociation (task-irrelevant focus) group after having been matched for both sex and fitness level. Those in the association condition were told to act as their own coach ("I can do better this time," "I can run further," etc.) and were told to pay close attention to the physical sensations of their body. The dissociation condition was also told to engage in self-talk but was also instructed to attend to the surrounding environment and to ignore any pain or discomfort resulting from the exercise. The authors do not specify whether the self-talk in the dissociative condition was the same type of self-talk that was used in the associative condition. Unlike the association condition, those in the dissociation condition were told to set short-term, realistic goals, to focus on their surroundings and pleasant distracting stimuli, and to replace any self-defeating thoughts with positive, externally focused coping thoughts. The experimenters asked the participants to describe their thoughts on a regular basis as they exercised in order to ensure proper attentional focus. The results showed that those in the dissociation condition attended class significantly more than those in the association condition did (η^2=.34). A three-month follow-up showed that seven of the original eight from the dissociation condition (87.5%) continued the three day per week exercise routine, whereas only three of the original eight from the association condition (37.5%) still exercised. Finally, a six-month follow-up found that three participants were no longer able to exercise due to extenuating circumstances, but of those who were, four from the dissociation condition (67%) and three from the association condition (43%) were still exercising. This study shows that adherence rates of novice exercisers increase when dissociation is used, supporting the hypotheses. One limitation of this study is that those in the dissociation condition were told to set short-term, realistic goals. This task would be more appropriate for an association condition as it requires focusing on the exercise. It also may be the cause of the increase in adherence. A second limitation was that the study did not control for intensity.

Synopsis

The researchers who have studied attentional focus have examined its effects on variables such as performance, perceived exertion, and exercise-related symptoms such as heart rate, fatigue, and pain. Some studies have measured attentional focus use, although most have implemented tighter experimental control by assigning differing strategies and comparing groups. When studying attentional focus, it is crucial to realize that its effect on exercise outcomes seems to vary according to two things: the level of expertise of the exerciser and the intensity level of the exercise. Past research on attentional focus has examined expertise and intensity separately, yet none has studied the simultaneous effect of both on attentional focus. Attentional focus is contingent upon these two things; studying the cognitive strategy of an exerciser is incomplete without the consideration of both expertise and intensity. The majority of researchers have concluded that association (task-relevant focus) enhances speed (but not endurance) for expert athletes and dissociation (task-irrelevant focus) enhances both speed and endurance for non-expert athletes (O'Connor, 1992; Rose, 1986). Some researchers have found that both strategies are used by experts because they dissociate during training and associate during competition (Raglin & Hale, 2005; Rose, 1986; Sachs, 1984). Future research is necessary to examine the effects that varying levels of intensity and expertise have on attentional focus.

In the following sections, both correlational and experimental studies that have examined attentional focus and its relationships and effects upon performance, endurance, and perceived exertion will be summarized and evaluated.

Attentional focus and performance: Descriptive and correlational studies

Masters and Lambert (1989) examined a sample of 48 marathon runners by mailing a questionnaire that was to be completed within 24 hours of finishing a race. The participants ran an average of 47.5 miles per week (*SD*= 7.9) as training and had completed an average of three marathons in the past. Questions were associative (body, pace monitoring, affect) and dissociative (problem solving, work, environment); these two categories were exhaustive and mutually exclusive. About 94% of the participants said that they associated (task-relevant focus) for the majority of the race. Prior to the race, participants were given an information packet and asked to report what they typically think about while training for a marathon; their answers were classified as either associative (task-relevant focus), dissociative (task-irrelevant focus), or both. The authors found that the participants used both cognitive strategies while training but only used association during the marathon. A weakness of this study is that the sample was self-selected and therefore may be biased.

Stevinson and Biddle (1998) sampled 66 non-elite marathon runners using their 2X2 attentional focus model. They divided their sample into two groups: those who "hit the wall" and those who did not. The authors developed a questionnaire to measure which strategy was employed. Each of the four attentional focus strategies was listed, along with a description and an example. Participants were asked to rate the proportion of the marathon spent using each strategy on an 8-point scale (0="no time at all," 4="about half the time," 8="all the time") and were told to make sure that ratings across the four categories added up to 8. They were also asked whether or not they hit the wall and, if so, to report at which point it happened during the run.

Of the sample, 53% reported hitting the wall. The majority of those who hit the wall said that they used an internal task-irrelevant strategy (M=0.89, SD=1.02); those who hit the wall employed this strategy significantly more than those who did not hit the wall (M=0.42, SD=0.56) (η^2=.47). The authors concluded that this cognitive strategy might be dangerous because it does not allow a runner to properly monitor the body in case of injury. Those who did not hit the wall reported that they used an internal task-relevant strategy most (M=2.90, SD=1.35), suggesting that it is the most advantageous. A significant negative correlation was found for the onset of hitting the wall and finish time (r=-0.51) and for amount of internal task-relevant focus and onset of hitting the wall (r=-0.39).

A limitation of the study is that the authors included "other runners" as external task-irrelevant. Whether focusing on other runners is related to the exercise or not depends on a person's purpose in doing so. For example, if the person is focusing on what the other runner is wearing, it qualifies as task-irrelevant; however, focusing on another runner can be considered task-relevant if it motivates a person to push himself harder or adjust his pace. A second limitation of the study is that the authors did not report the performance times of the marathoners but only focused on whether or not they hit the wall. It would have been beneficial to have identified the marathoners' levels of expertise according to their performance times and compared any differences in attentional focus between the groups.

In summary, Masters and Lambert (1989) concluded that the majority of marathon runners associate (task-relevant focus), and Stevinson and Biddle's (1998) study specified that an internal task-relevant focus is the most beneficial for marathoners to avoid hitting the wall. These two correlational studies only tested marathon runners; therefore, the conclusion that focusing on bodily sensations enhances performance may not apply to other levels of expertise. Further research is necessary to confirm and expand on these findings.

Attentional focus and performance: Experimental studies

Okwumabua et al. (1983) tested whether novice runners had the ability to enhance their performance once they had been taught how to use an assigned cognitive strategy. Thirty-one undergraduate students were divided into one of three conditions: association (task-relevant focus), dissociation (task-irrelevant focus), and a relaxation-control condition. Participants in the association condition were instructed to attend to their breathing, muscle fatigue, and other bodily sensations, while those in the dissociation condition were instructed to attend to an object unrelated to running and continuously repeat a phrase or mantra. The relaxation-control condition participants were taught relaxation exercises. The authors obtained this sample through a "Jogging for Fitness" course; none of the participants had run over 25 miles in the past year. Five trials were completed over the course of five weeks; each trial was a one and one half mile run on a 440-yard oval track. During the first, third, and fifth trials, a self-report measure of attentional focus was administered and the amount of time needed to run the $1^{1/2}$ mile track was recorded. The first trial was used as a pretest trial to observe participants' natural attentional focus. The participants were instructed to mark which types of thoughts they had while running. Associative thoughts pertained to running task-demands and performance, such as feelings of tension in the arms and other runners' placement, while dissociative thoughts were related to distraction from task demands and performance, including attending to the environment and counting backwards. Each participant had a single association/dissociation score ranging between 0 and 1.00, with a score between 0 and .49 indicating a participant mainly dissociated, a score between .51 and 1.00 indicating association was mainly used, and a .50 indicating equal use of each strategy.

The results showed that there were no differences between the groups at the start of the study. Initial analyses between the assigned groups showed no significant differences in performance times; however, the researchers determined that not all of the participants employed their assigned attentional strategy, and conducted a new analysis based on the strategies that the participants actually used. Fifteen of the participants reported that they had actually associated, and 16 reported that they had dissociated. The results showed that performance times significantly decreased over the course of the trials for both groups (η^2=.22), but that the performance times of those who dissociated improved significantly greater over the course of the trials compared to those who associated (η^2=.14). By the third trial, those in the dissociative condition ran the course in 12.6 minutes, while those in the associative condition ran it in 13.6 minutes. The results show that dissociation is a more effective cognitive strategy for novice runners with regard to increasing pace. Okwumabua et al. (1983) explain that novice runners do not have the same "physical skills" that more experienced runners have that allow them to monitor pain and fatigue that results from exercise. The authors state that an associative strategy only becomes effective and enhances performance as time progresses and experience is gained. The main weakness of this study is that the manipulation of attentional focus was unsuccessful. A second weakness is that the authors did not clarify any differences between the participants who disregarded the experimenter's instructions and used the cognitive strategy that they preferred versus the participants who employed the assigned strategy, not because they preferred it, but because they were compliant. Differences in compliance between participants could have potentially confounded the results.

Harte and Eifert (1995) measured the attentional focus of amateur triathletes or marathon runners after four runs (for a combination of 10 participants). All of the participants completed each of the four run conditions. The first run was a 12-kilometer outdoor run around a college campus that lasted no more than 45 minutes. The second and third runs were both completed indoors on a treadmill; each run consisted of a 15-minute warm-up and a 30-minute run. For one of the indoor runs, participants wore headphones and listened to a tape of "outdoor noises" (indoor run-external focus).

During the other indoor run, participants wore headphones and listened to their own breathing (indoor run-internal focus). Pace was set at about 9-11 mph for both of the indoor runs. Pace was determined based upon participants' reports of comfort and rating of perceived exertion (RPE) that had been assessed at an introductory session. The final condition was a control condition, in which participants read a sports magazine while sitting quietly for 45 minutes. Attentional focus was measured using an attention checklist that was developed by the authors. It consisted of 28 words that described 17 external/environmental words and 11 internal/physiological words. Participants were encouraged to mark which items they focused on, as well as to list any words that were not included on the checklist. The authors tallied the number of external versus internal words marked by each participant to classify whether they associated or dissociated.

The researchers concluded that the participants associated more during both of the indoor runs and focused on the surrounding environment more during the outdoor run (η^2=.89); 66.4% of the items marked on the checklist following the indoor-external stimuli run and 84.6% of marked items following the indoor-internal stimuli run were internal focus items, whereas 16.5% of the items marked following the outdoor run were internal focus items. Perceptions of exertion were significantly higher in all conditions compared to the control condition. Also, ratings of exertion were significantly higher during the indoor run-internal stimulus condition compared to the indoor run-external stimulus condition. This is consistent with previous research showing that an association condition elicits higher exertion ratings compared to a dissociation condition.

A limitation of Harte and Eifert's (1995) study is that only males were tested. Also, the authors only controlled intensity during the indoor runs. The participants were instructed to run for 30 minutes at their typical pace. The outdoor run lasted no more than 45 minutes, and the participants were simply instructed to run 12 kilometers; pace was not measured. It is understandable that it is difficult to control pace during an outdoor run; however, without this factor controlled, it does not allow for equal comparison between the indoor and outdoor conditions. The authors did not state that they were assuming that the pace would be similar between the indoor and outdoor runs, but they must have taken this approach because they instructed the participants to choose a pace for the indoor run at the typical pace they would run during an outdoor run. Therefore, it is unclear whether the pace was a low, moderate, or very hard intensity for each participant. Pace or intensity may have differed between the indoor and outdoor runs and may be responsible for the differences in attentional focus that the authors found. A final limitation is that the attention checklist utilized was developed by the authors, and no evidence of reliability or validity was provided.

Scott et al. (1999) instructed nine collegiate varsity rowers to row as far as possible on a rowing ergometer within a 40-minute period. The authors employed a multiple baseline design over a period of 10 sessions. Participants were able to see the total distance rowed, split times, stroke rate per minute, and a countdown of time remaining as they rowed. Each participant was assigned to one of three conditions: an association (task-relevant focus) condition, in which a video was shown of a woman encouraging the rower to "feel the burn" and directing them to pay attention to their breathing; a dissociation (task-irrelevant focus) condition, in which a video of a rowing race was shown; and a second dissociation condition, in which music was played. The results showed that all three conditions led to increased performance (compared to baseline performance), but the association condition produced the most significant improvements. The association condition improved their performance by an average of 336 meters (3.77%), the dissociation (video) condition improved by an average of 117 m (1.27%), and the dissociation (music) condition improved by an average of 67 m (0.77%). A limitation of this study was that one of the dissociation conditions was subjected to an associative task. Although showing a video can be a dissociative task, the content of the video determines whether it will in fact induce dissociation. Scott et al. (1999) showed a video of a rowing race, which was the exact task that the participants were performing. Clearly, this is a confound in their methodology.

Connolly and Janelle (2003) also sampled college varsity rowers using rowing ergometers in their study. The first experiment was a within-subjects design in which participants associated (task-relevant focus) in one condition by focusing on their breathing, technique, or bodily state, and dissociated (task-irrelevant focus) in the second by focusing on three collages. Resistance was kept at a "steady state" (70% pressure), and participants were able to see their heart rate on a wrist watch throughout the bout. The researchers found that those in the association condition rowed significantly further compared to those in the dissociation condition (η^2=.36), but there was no difference in ratings of perceived exertion or heart rate. A limitation of this study is that RPE was assessed every four minutes and heart rate was monitored for both of the groups; it is a potential confound to have those in a dissociation condition assess exertion and heart rate frequently because it could force their attention inwardly and hence induce association. Also, there was no manipulation check to ensure that the assigned strategies were actually used.

The second experiment in the study employed a 2X2 attentional focus within-subjects design modeled after Stevinson and Biddle (1999). Before beginning the session, 24 college varsity rowers completed the Attentional Focus Questionnaire (AFQ) as a baseline measure to assess the attentional style they preferred before being assigned to one. The authors later assigned participants to a cognitive strategy and then compared the performance times of the preferred strategy versus the assigned strategy. The participants were told to keep their heart rate between 160 and 180 beats per minute. It was found that the internal as well as external association conditions resulted in significantly faster times compared to the baseline performance and that the two association conditions rowed significantly faster compared to the internal dissociation condition, but not the external dissociation condition. Also, the association conditions resulted in significantly higher heart rates and exertion ratings compared to baseline (η^2=.21). This study has the same weakness as the first study: having the participants in the dissociation condition monitor heart rate is a potential confound.

A final study that measured performance as a function of attentional focus was conducted by Couture et al. (1999). Sixty-nine recreational swimmers completed a baseline swim (regular swim) and an experimental swim. During the experimental swim, the participants were told to swim fast and comfortably, but not to treat the swim as a race. Before beginning, an explanation describing attentional strategies was given. Each participant was assigned to either an association (task-relevant focus), internal dissociation (internal task-irrelevant focus), external dissociation (external task-irrelevant focus), or control condition. Those in the association condition were instructed to imagine and focus on the word "air" with each inhale of breath and to ignore any feelings of exertion. The internal dissociation condition was told to imagine doing something enjoyable that was not related to the swim and to ignore feelings of exertion. Finally, the external dissociation condition was told to focus on the geometric shapes at the ends of the pool and to count how many squares, circles, and triangles they saw overall during the swim. The results showed that those assigned to associate swam significantly faster during their experimental swim compared to the baseline swim (η^2=.11). There was no difference in performance times between the two swims for those in the dissociation and control conditions. When asked whether they used the assigned strategy, only 30% of the participants said that they did. About 25% reported that they used it most of the time, and 21% used it part of the time. A total of two participants admitted to never using the strategy assigned to them. This is an obvious limitation to the study. It is also possible that the participants did not understand how to use the cognitive strategies, which leads to a second limitation: the instructions that were given for each strategy may not have been clear. By simply repeating the word "air" with each inhale in the association condition, it may not have been effective enough to force the participants to focus internally. It was also inaccurate to have the participants ignore any feelings of exertion in the association condition, as exertion is an internal sensation that is related to the exercise; this is incongruent with other researchers' definition of association. Couture et al. (1999) should have performed a manipulation check to ensure the proper usage of the three assigned strategies.

As can be seen, performance improves through the implementation of attentional focus strategies. Which strategy is the most efficient depends on the experience level of the person. Okwumabua et al. (1983) showed that a dissociative strategy works best for novices, whereas the study by Couture et al. (1999) showed that an associative strategy worked best for swimmers at the recreational level of expertise. Finally, Scott et al. (1999), Harte and Eifert (1995), and Connolly and Janelle (2003) showed that association is also the most effective strategy to enhance performance for those with greater experience. Future research needs to investigate the effects of attentional focus on performance using a sample that does not consist of only one type of athlete (e.g. novice, recreational, expert) but one that includes varying levels of expertise to allow for comparison between them.

Attentional focus and level of expertise

The issue of studying attentional focus becomes even more important when coupled with experience level of the participants. For example, a novice runner cannot maintain the same pace as an expert runner due to differences in physiologic conditioning and accompanying differences in perceived exertion. Much of the research on attentional focus has noted which cognitive strategies are adopted by populations ranging from expert runners to novice runners; experts prefer association (task-relevant focus) and novices prefer dissociation (task-irrelevant focus). An important concern is what method researchers are using to classify runners. There are no set guidelines for researchers to distinguish among expert, recreational, or novice runners. Due to this, there have been inconsistent qualifications for levels of expertise in past studies, and the use of the terminology has varied from study to study. Some research has identified the qualifications that differentiate novice, recreational, and expert runners from one another, while other research does not operationalize their usage of these labels.

Experts are different from sub-elite exercisers because they push their bodies to a point of struggle and an enduring strain (Schraw, 2005). In an interview conducted by Schraw (2005), Ericsson describes physiological differences that distinguish experts from other levels of expertise. Experts have hearts that are larger than average, allowing them to pump a greater amount of blood to large muscle fibers. Their bodies also have a greater number of capillaries and larger than average arteries to transport blood in an efficient manner.

Deliberate practice has been used as a method of identifying differences between levels of expertise (Abernethy, Farrow, & Berry, 2003; Ericsson, 2003). According to Ericsson (2003), experts engage in practice that requires a great amount of effort, is not inherently enjoyable, is relevant to the domain of interest, and is designed so that the athlete can enhance performance. There is an obvious distinction between novice athletes and expert athletes; when people first begin participating in a sport, a lot of conscious attention is required to learn how the sport is performed. As expertise increases, fewer mistakes are made, and athletes can advance to a level where they no longer need to devote all of their cognitive resources to performing the sport. Expert athletes are differentiated from recreational athletes because they constantly adjust their performance based upon feedback that they receive from coaches, themselves, or fellow athletes. Whereas recreational athletes work to maintain their performance status, experts push themselves to continue to improve their ability and reach the next performance level.

The Stages of Change model (i.e., Transtheoretical Model) is a theoretical model that indicates a person's current status regarding their intentions for changing a future behavior. The model has been applied to changing a number of health behaviors such as smoking, losing weight, and exercising. Marcus, Selby, Niaura, and Rossi (1992) developed a Stages of Change measure for exercise that distinguishes participants based on their self-reported amount of physical exercise they currently engage in or plan to engage in. Participants are categorized into one of five stages: pre-contemplation, contemplation, preparation, action, and maintenance. The first stage, pre-contemplation, is defined as participants who do not exercise regularly (at least 3 days per week and 30 minutes per session) and have no inclination to begin an exercise routine. Those in the contemplation stage also do not exercise regularly, but express that they are considering beginning an exercise routine in the near future. The preparation stage is used to classify participants who do exercise, but not regularly. Participants who exercise regularly, but have done so for less than 6 months, are categorized in the action stage. Finally, participants who have been exercising for at least 6 months are identified as being in the maintenance stage. The TTM is a useful way to distinguish participants based on expertise and is used in the current study's methods. Using it for this purpose is a relatively new practice; previous experimenters used simpler terms to define expertise, such as in the following studies.

There have been inconsistent findings as to which type of cognitive strategy runners with differing levels of experience use. Research on attentional focus began with a study by Morgan and Pollock in 1977 in which psychological characteristics of 27 world-class athletes and collegiate middle distance runners were studied. Morgan and Pollock (1977) compared the collegiate runners' psychological characteristics to those of marathoners and concluded that cognitive strategy was the only characteristic that distinguished them; the marathoners associated (task-relevant focus) and the collegiate runners dissociated (task-irrelevant focus). The two groups did not differ on traits including affect, introversion/extroversion, depression, tension, and vigor. This study is a good example of the terminology used to describe participants. Although a difference in attentional focus use was found, the authors did not specify exactly why world-class athletes are different from collegiate middle distance runners. It can only be assumed that the world-class athlete sample has more experience than the college runner sample, and this is a judgment based solely on their titles.

Silva and Appelbaum (1989) also assessed the cognitive strategies of 32 United States Olympic Marathon Trial contestants, but their method differed from Masters and Lambert (1989) in that they divided the runners into the top 50 finishers and the lower 50 finishers to investigate whether differences between the two existed. On the night before the race, each runner completed the Running Styles Questionnaire (RSQ) and a short interview. The RSQ is a self-report measure that is made up of 12 multiple-choice and six open-ended questions. The participants were told to rate the percentage of time they associated (task-relevant focus) versus dissociated (task-irrelevant focus). An example of a multiple-choice question was "When pain or fatigue is felt during the *early* (5-8 miles) part of the marathon race, how often do you attempt to distract your thoughts away from the pain by thinking about something totally unrelated to the run?," and an example of an open-ended question was "State three phrases or ideas you tend to concentrate on when you are attempting to distract your thoughts away from pain." A total of 32 United States Olympic Marathon Trial contestants participated in the study; 11 finished in the top 50 and 21 finished in the bottom 50. Those in the top 50 indicated on the RSQ that they dissociated nearing the end of the marathon to distract themselves from pain.

Overall, the results of the study showed that the top finishers associated more than the bottom finishers did throughout the race (η^2=.31). During the early stages of the marathon, the top finishers switched between association and dissociation (η^2=.31) and the bottom finishers mainly dissociated (η^2=.31). The authors explain the importance of switching between the two strategies. Association allows the runner to adjust his or her pace and keep up with the runners leading the race, while dissociation is beneficial because it helps to pass the time during the early stages of the race. The top finishers also reported that they engaged in self-talk (they used positive self-talk throughout the race) whereas the bottom finishers did not (η^2=.31). Finally, the top finishers were different from the bottom finishers because they consciously "marked" other runners often during the early stages of the race. The purpose of this is to observe where the top runners are and what kind of pace they are setting during the early stages of the race.

This study lends great support for differences in cognitive strategy based upon skill level and differing stages of a race. The cognitive strategies of runners are not always constant during a marathon; they attempt to pace themselves during the early stage of the race to facilitate endurance and push themselves in the final stage to maximize performance. A weakness of this study is that although they divided them according to where they placed in the race, it is still a sample of strictly expert runners.

In 1986, Schomer sampled a group of participants whose experience level varied, including four novice, two average, and four superior runners. The levels of expertise were distinguished based upon history of physical activity and marathon racing. Those who had participated in regular activity (i.e. three times a week or greater) for less than 5 years and were preparing for their first marathon were classified as "novice," those who had participated in at least two marathons and whose race times were between 3 and 4 hours (males) or 3 ½ to 4 ½ (females) were classified as "average," and those who had race times less than 3 hours (males) or below 3 1/2 hours (females) qualified as "superior." The participants spoke into a microphone during training runs that lasted between 45 to 120 minutes, commenting on their thought processes. Their reports were then classified as either associative or dissociative using a classification system that defines ten attentional focus sub-categories. The ten categories were feelings/affects, body monitoring, command/instruction, pace monitoring, environmental feedback, reflective activity thoughts, personal problem solving, work/career/management, course information, and talk/conversational chatter. The first four were considered associative thoughts, whereas the last six were dissociative thoughts. The experimenter instructed the participants to run at their usual intensity level; pace was not measured.

The results showed that the majority of the runners associated (task-relevant focus). Schomer (1986) did note a distinction between the superior runners and the other two groups: the superior runners associated much more often. They mentioned how specific body parts felt, whereas the novice and average runners did not. This method of measuring attentional focus is a both a weakness and a confound. Requiring participants to speak out-loud may have led them to focus on things such as breathing rate. Thus, it is of no surprise that, given a hard enough intensity, most of the runners associated. A second weakness is that there was no control of pace during the runs. Schomer (1986) only made certain that the length of the run was at least 45 minutes and at most 120 minutes; pace was not taken into consideration.

Some studies have compared inexperienced runners to trained athletes, such as Brewer and Van Raalte's (1996) comparison of 35 college students (who were not competitive distance runners) to nine cross-country runners. Participants were told to exercise as fast as they could for 12 minutes on a stair climber. Attentional focus was measured both before (as the preferred cognitive strategy) and after (as the actual cognitive strategy) the exercise bout using the Attentional Focus Questionnaire (AFQ); this was the first study that measured preferred attentional focus. The results of this study were also consistent with previous research. The cross-country runners stated that they preferred association (task-relevant focus) before completing the bout and did in fact associate during the task significantly more than the students (η^2=.09). The students reported that they preferred dissociation (task-irrelevant focus) before the bout and did dissociate while on the stair climber significantly more than the cross-country runners (η^2=.22). A weakness of this study is that the authors did not control for intensity. The only mention of the intensity level of the stair climber is that it was set at Level 9; steps per minute were not reported.

A few studies have produced contradictory findings. Wrisberg and Pein (1990) compared the attentional focus of 87 experienced and 100 inexperienced recreational runners. Expertise was determined based upon demographic information that assessed running experience; no further specification of how the participants were identified regarding expertise was given. Immediately after completing a run on an outdoor track, participants were approached and asked if they were willing to complete the Attentional

Focus Questionnaire (AFQ); pace and intensity were not assessed. The results showed that the experienced runners scored higher on dissociation (task-irrelevant focus) (η^2=.05), while the inexperienced runners scored higher on association (task-relevant focus) (η^2=.05). The researchers concluded that experienced runners are better at blocking out pain and discomfort due to the exercise, whereas inexperienced runners are not. A possible explanation for this finding is that although the authors classified some of the runners as "experienced," they do not meet the same qualifications as expert. Another explanation is that the results of this study concerning the experienced runners are not contradictory with other literature because it has been found that experienced runners do in fact dissociate during training runs (Masters & Lambert, 1989; Raglin & Hale, 2005; Rose, 1986; Sachs, 1984); however, there is no evidence that inexperienced runners associate during training. Therefore, if the exercise in this study can be considered a training run, the results partially coincide with the rest of the literature on attentional focus and levels of expertise.

In summary, by measuring which type of cognitive strategy was employed by people who differed based on level of experience, past research has shown that novices and recreational runners prefer dissociation (task-irrelevant focus) whereas those with more experience (such as marathoners, superior runners, and world class athletes) prefer association (task-relevant focus). Silva and Appelbaum (1989) went into more detail by showing a difference between those who place at the top versus the bottom in a marathon; those who finished first switched between both strategies, while the bottom finishers mainly dissociated. Schomer (1986) also reported that the superior runners associated by focusing on their bodies in a much more specific way compared to the average and novice level runners. Lastly, Wrisberg and Pein's (1990) study showed that following a training run, experienced recreational runners mainly dissociated and inexperienced recreational runners associated. This finding for experienced recreational runners concurs with the literature that states that attentional focus use differs depending on whether the activity is training or a competition.

Attentional focus and exercise-related symptoms: Experimental studies

There have been a number of articles that have examined the effect of watching television or listening to music (both are examples of task-irrelevant focus) on exercise-related symptoms and performance. One such study was conducted by Nethery (2002). Thirteen untrained males were tested during a cycling session. Each participant completed four sessions, each at a moderate and very hard intensity (50% VO^2_{peak} and 80% VO^2_{peak}, respectively), which lasted 15 minutes; ratings of perceived exertion were taken every five minutes. Four different attentional strategies were assigned. In the first condition, participants wore opaque goggles and earplugs to deprive them of sensory stimulation. This condition is analogous to an association (task-relevant focus) condition. Participants in the second condition were given music to listen to, as well as opaque goggles to wear (dissociation/task-irrelevant focus condition). The third condition consisted of wearing earplugs and watching a video on skiing (dissociation/task-irrelevant focus condition). The final condition was a control condition, in which participants exercised in a bland environment.

Each of the conditions resulted in a significant increase in exertion ratings between the 5, 10, and 15-minute interval RPE reports. This occurred across both of the intensity levels, but they were greater during the very hard intensity bouts. Those in the sensory deprived (association) condition rated exertion significantly higher compared to any of the other conditions. Exertion ratings were significantly lower in the music condition at both the moderate and very hard intensities compared to the other three conditions. Finally, those in the video condition rated exertion similarly to those in the control condition.

The results of this study show that when participants are forced to focus internally (sensory deprived condition), perceptions of exertion are magnified compared to when music is listened to or television is watched. A limitation of this study is that RPE was collected every five minutes, which is a confound when trying to induce dissociation. Also, the ecological validity of this study is questionable because the dissociative task of watching a video while wearing earplugs is unrealistic, as is wearing opaque goggles during exercise. Under typical circumstances, vision is not obscured and auditory-stimuli accompany a video.

Fillingim and Fine (1986) also conducted a study in which exercise-relevant symptoms were assessed regarding attentional focus. Fifteen students identified as "active joggers" ran one mile on an indoor track. Participants were assigned to one of three conditions: a word cue condition (external focus), breathing condition (internal focus), and a control condition. In the word cue condition, participants concentrated on counting the number of times a particular word was heard over a set of headphones while they ran, while in the breathing condition, participants were told to pay attention to their own breathing and heart rate. Those in the dissociation (task-irrelevant focus) condition were able to report accurately the occurrence of the word cue. Everyone was told to run as fast as they could, without inducing pain or discomfort; pace was not assessed. The results of the study showed that those in the word-cue condition reported significantly fewer symptoms compared to those in the breathing and control conditions (η^2=.32). Two limitations of this study are the lack of a manipulation check for the association condition and that the authors did not describe their definition of "active jogger."

In a study conducted by Pennebaker and Lightner (1980), 57 male college students were assigned to walk for about 10 minutes on a treadmill at a speed of 3.4 mph and a grade of 12° on two separate days. The authors did not specify the expertise level of the participants. On the first day, the participants wore a set of headphones but did not listen to anything, but on the second day they were assigned to listen to either street sounds, their own breathing, or nothing. There was a significant increase in perceived fatigue for those in the breathing condition (η^2=.11) between the two days, but no difference between the sounds and control conditions. Also, participants in the sounds condition reported fewer symptoms on the second day compared to what they had reported on the first day, (η^2=.11). Lastly, those in the breathing condition were significantly more tense on the second day compared to the first day (η^2=.11).

Russell and Weeks (1994) were interested in the effects of association (task-relevant focus) and dissociation (task-irrelevant focus) on heart rate and perceived exertion. Seven trained male cyclists each completed three cycling bouts at 75% of their maximal heart rate that lasted 60 minutes. In the first condition, they attended to feedback concerning their heart rate (associative condition). The second condition consisted of watching a video that was not related to the exercise and responding to key words that appeared (dissociative condition). The final bout did not have an attentional focus manipulation (control condition). The results showed that there were no significant differences between any of the conditions for either heart rate or exertion ratings. Although the finding was not significant, the exertion ratings were higher in the dissociation condition compared to the other two conditions. Exertion ratings are typically higher in association conditions, as can be seen in previously mentioned studies. It is possible that the exertion ratings were higher in the dissociation condition because the participants were trained cyclists who became annoyed with forcing their attention away from task relevant cues and toward responding to key words in the video. Since they were trained cyclists, this dissociative task may have made time pass more slowly, and therefore increased feelings of exertion. Four of the participants reported that the association bout was the easiest of the three. Clearly, the dissociative task was not salient enough. This study by Russell and Weeks (1994) serves as an example of the difficulty in manipulating attentional focus.

To summarize, of four studies that have manipulated attentional focus and observed its effects on exercise-related symptoms, three have found that an associative (task-relevant focus) strategy leads to a magnification of symptom recognition and that a dissociative (task-irrelevant focus) strategy leads to a decrease in symptom recognition. Again, the study by Russell and Weeks (1994) produced inconsistent results due to its weak methodology. It is important to note that the intensity levels of the tasks in these studies had an influence on symptom reporting: higher levels of intensity lead to significantly greater reports of exertion. The intensity level of the assigned exercise bout is not always taken into consideration when designing an attentional focus study; however, as the following evidence shows, studies should control for it.

Attentional focus and intensity

One aspect of attentional focus research that has not been sufficiently studied is the effect of exercise intensity on attentional focus. Much of the research has been conducted without controlling the intensity of the exercise performed. Also, most studies that have measured attentional focus (instead of manipulating it) have not varied intensity levels. It is possible that attentional focus varies at low or moderate intensities and is more stable at very hard intensities. Increased heart rate and respiration (among other things) follow from exercising at harder intensities; hence, it is logical to assume attention would be directed inwardly to these physiological changes. Tenenbaum (2001) discusses a similar point about conscious perception of physical effort. Processes such as breathing are unconscious under normal (minimal intensity) conditions, but as intensity increases, so does awareness of these sensations. Once a person is struggling to catch her breath and can feel her heart racing, attention is forced internally to these physiological reactions to the exercise. Rejeski (1985) also believes that when one exercises at a hard intensity, one is forced to focus on the sensory stimulation of the body.

To provide empirical evidence for this theory, Hutchinson and Tenenbaum (2007) examined changes in attentional focus while controlling for intensity level of exercise. The experimenters hypothesized that participants would be able to shift their attention between association and dissociation at a low intensity, but would not have the ability to voluntarily dissociate during a high intensity. Thirteen graduate and undergraduate students completed a 15-minute cycle ergometer task while heart rate and VO^2_{max} were recorded. The 15-minute bout was divided into three intensity levels. The participants cycled at 50% VO^2_{max} for the first 5 minutes, 70% VO^2_{max} for the second 5 minutes, and to exhaustion at 90% VO^2_{max} for the last 5 minutes. Attentional focus was measured by instructing the participants to state their thoughts out-loud during the cycling task. Their thoughts were then categorized by two raters as either associative or dissociative using Schomer's (1986) classification system.

The results showed that 93% of reported thoughts were associative (task-relevant focus) during the high intensity bout, 78% of reported thoughts were dissociative (task-irrelevant focus) during the low intensity bout, and 61% of reported thoughts were associative during the moderate intensity bout. These results support the authors' hypotheses; attentional focus did change depending on the intensity level of the exercise. Specifically, as intensity increases, the tendency to voluntarily direct one's attention to either dissociative or associative thoughts diminishes and associative thoughts predominate (Masters & Lambert, 1989).

A weakness of this study is that the order of the assigned intensity levels was not counterbalanced. Also, the method of having participants verbalize their thoughts during an exercise task is a possible confound because it could bias them to report certain types of thoughts or cause them to censor their thoughts due to self-consciousness. Lastly, as the authors suggest, the environment may have influenced the participants to report their thoughts in a certain way. According to J. C. Hutchinson (personal communication, July 23, 2007) the environment for this study was a private dimly lit cycling studio with no windows or glass doors. There were no external stimuli (no TV or radio playing, nothing on the walls, and no decoration); therefore, the environment could have biased participants' attention toward association. It is important that the environment be controlled for by ensuring that some stimuli are present in order to allow for any kind of attentional focus to occur.

Goode (1996) also examined differences in attentional focus while manipulating intensity. One hundred college students were tested in a lab complete with external stimuli (posters, a window, and maps). Participants were randomly assigned to cycle for 20 minutes at either a moderate or high intensity. Those in the moderate intensity condition were instructed to pedal "at a leisurely rate" but not to over-exert themselves, and those in the high intensity condition were told to exercise as if they were competing in a race. Participants' heart rates were monitored using a stethoscope throughout the bout, and those in the moderate intensity condition were reminded to pedal at a slower rate if their heart rate exceeded 130 beats per minute, while those in the high intensity were reminded to pedal at a faster rate if their heart rate dropped below 150 beats per minute. The participants were asked to rate their intensity using Borg's RPE scale once every four minutes. The experimenter recorded the distance pedaled at the end of each participant's bout. The Thoughts During Cycling Scale (TDCS) was used to measure attentional focus following the exercise bout. The TDCS uses 5-point scales (0=Never to 5=Very Often) to assess the frequency of associative (task-relevant) and dissociative (task-irrelevant) thoughts. Specifically, the TDCS asks participants if they focused on associative information, external surroundings, daily events, spiritual reflection, and interpersonal relationships.

Analyses of heart rate showed significant differences between participants in the moderate and high intensity conditions, $F(6, 91)=72.48$, $p<.0001$; those in the high intensity condition had significantly higher heart rates throughout the cycling bout compared to those in the moderate intensity condition. Participants in the high intensity condition (*M*=3.5 miles) also pedaled a significantly further distance compared to those in the moderate intensity condition (*M*=2.7 miles), $F(1, 96)=64.07, p<.0001$. A main effect for RPE was found; high intensity condition participants reported higher RPE scores throughout the bout compared to the moderate intensity condition participants, $F(4, 93)=14.51, p<.0001$. A main effect for associative focus was also found between the conditions, $F(1, 96)=18.33, p<.0001$. The high intensity condition participants reported significantly more associative thoughts compared to the moderate intensity condition participants (26% and 10%, respectively).

One limitation of this study is that, by assessing RPE every four minutes and periodically checking their heart rate using a stethoscope, it could have potentially biased the participants to associate. Overall, these participants focused on dissociative thoughts more so than associative; however, this study provides support that higher intensities lead to an increase in associative focus. Hence, the results of this study concur with Hutchinson and Tenenbaum (2007).

A final study that has examined intensity of exercise while measuring attentional focus was conducted by Tammen (1996). Eight middle and long distance runners ran five separate trials. For the first three to four trials, participants were instructed to run 1500 meters on a flat track at a submaximal pace [mean VO^2 rates (ml/kg/min) per trial: 47, 51, 53, 57], while they were told to run 2300 meters at a maximal pace [VO^2 (ml/kg/min)=61] for the fifth trial. Upon completion of each trial, participants completed the Mental Readiness Form (MRF) to assess their thoughts and feelings. Questions were either associative (task-relevant) or dissociative (task-irrelevant). Participants wore a watch that measured their heart rate while they ran, and RPE was recorded. A golf cart was used to pace the participants properly.

The data analysis found that as pace (i.e., intensity) increased with each trial, dissociative thoughts decreased, focus on bodily sensations increased, and RPE increased. The average association score during the first four trials was 36.58 (*SD*=21.06) while the average score during the fifth trial was 15.75 (*SD*=9.53); lower numbers indicate a higher associative focus. A limitation of this study was that using a golf cart to pace the participants and having them wear a mask to record VO^2 rates are potential confounds. Both may have biased the participants by unintentionally cuing them to associate. This study lends further support that differences in intensity influence whether an exerciser focuses on task-relevant or task-irrelevant information.

To conclude, it is important to control for the intensity of exercise. As Hutchinson and Tenenbaum (2007), Goode (1996), and Tammen (1996) have demonstrated, attentional focus can change due to differences in intensity of exercise. Also, as has been mentioned, cognitive strategies may differ based upon level of expertise; yet, no studies have measured attentional focus while controlling for intensity level and level of expertise.

Theoretical background of attentional focus research

The Parallel Processing Model (PPM) was developed by Leventhal and Everhart (1979) as a theoretical framework for pain perception. It has since been applied to attentional focus research as a means of explaining why people benefit from the use of cognitive strategies. Leventhal and Everhart (1979) explain that when a painful event is experienced, it is mostly processed preconsciously. This implies a separation between perception and focal awareness; perception refers to all possible stimuli to which one can attend, while focal awareness is the information to which one does attend. The authors also explain that the model incorporates attentional filters that bring information from perception into focal awareness. In his article, Rejeski (1985) explains that aversive stimuli can be blocked from focal awareness by using distracting stimuli (i.e., a dissociative cognitive strategy).

The PPM also incorporates affective reactions to stimuli, specifically, negative emotional reactions to aversive stimuli. This can readily be applied to exercise in that many people interpret the bodily sensations that result from exercise in a negative way. Some researchers have referred to this idea and linked it to attentional focus research by stating that a task-relevant focus would be disadvantageous for a person who interprets exercise in a distressing manner (Brewer, Van Raalte, & Linder, 1996; Brewer & Buman, 2006). Instead, as Rejeski (1985) suggested, a task-irrelevant strategy would work best because it would block focal awareness of aversive task-relevant aspects resulting from the exercise. These researchers go on to say that this type of person would benefit from a task-relevant strategy after gaining exercise experience because he or she would no longer have a negative expectancy toward it.

As shown by Hutchinson and Tenenbaum (2007), Goode (1996), and Tammen (1996), task intensity plays a role in focal awareness; increasing intensity leads to an increased focus on task-relevant information. This can be combined with Rejeski's (1985) research on the PPM and perception of aversive physical symptoms. Rejeski (1985) stated that if exercise intensity is very high and the exercise is perceived as negative, bodily sensations will dominate perception and one will be forced to attend to them.

The PPM gives good theoretical background to attentional focus research. It explains why a task-relevant focus works best for people who are accustomed to the bodily sensations that result from exercise, and a task-irrelevant focus is most beneficial for people unaccustomed to these bodily sensations who may interpret them in an aversive way.

Summary of the literature

In summary, the association/dissociation model of attentional focus has since been updated to a 2X2 model: internal task-relevance, external task-relevance, internal task-irrelevance, and external task-irrelevance. Differences in attentional focus have been observed based on differing levels of running expertise. Novice runners typically have a task-irrelevant focus, recreational runners adopt both an internal and external task-irrelevant focus, and expert runners adopt both an internal and external task-relevant focus. A task-relevant focus has been shown to aid performance for experts, whereas a task-irrelevant focus is the most efficient for novices. Changes in the intensity level of exercise are thought to increase symptoms related to the exercise, thereby inducing an internal task-relevant focus; however, very few studies (Goode, 1996; Hutchinson & Tenenbaum, 2007; Tammen, 1996) have manipulated intensity and measured changes in attentional focus. Moreover, no studies have done so while simultaneously examining differences between expertise levels; this is the purpose of the current study.

The existing literature on attentional focus is inconsistent not only with regard to terminology, but also in how attentional focus is manipulated. Some studies have assigned a dissociative task that is actually an associative task, and vice versa. For example, a few studies have assigned a dissociative task of watching a video while wearing earplugs (Nethery, 2002). Wearing earplugs while exercising can possibly draw attention to the sound of one's heartbeat or breathing, which is an associative focus. Other studies that have failed to manipulate attentional focus successfully include Couture et al. (1999) and Morgan et al. (1983). Seventy percent of the participants in Couture et al. (1999) admitted that they did not use their assigned strategy; those in the associative condition were told to imagine repeatedly the word "air" as they swam. Morgan et al. (1983) instructed their participants in the dissociative condition to imagine repeatedly the word "down" while running on a treadmill. These are similar tasks, yet one was labeled association and other was an induction of dissociation. There needs to be consistency in the literature concerning how attentional focus is defined, how many dimensions there are, and exactly what tasks fall into which dimension. There also needs to be agreement between studies on differences between attentional focus use during a 20-minute run in a controlled lab versus a marathon run versus a 5k or 10k run, because distance and/or duration of exercise may affect attentional focus. The correlational research on attentional focus examines marathon runs, but 5k and 10k runs are much more common. Finally, studies that assign attentional focus must utilize a manipulation check to ensure its success. Otherwise, conclusions based upon the assumption that participants adhered to their assigned focus are invalid.

Hypotheses

1. The current study predicts that pre-contemplation/contemplation runners will focus on external distractions at the moderate (65% HR_{max}) intensity (Table 3). Pre-

contemplation/contemplation runners are not accustomed to their body's physiological response to the strain of running; therefore, they will attempt to focus their attention away from the discomfort during the moderate intensity bout (Leventhal & Everhart, 1979; Rejeski, 1985). Due to the lack of research on the attentional focus of preparation and action level runners, it is not possible to form an educated hypothesis on which type of focus they will have at the moderate level of intensity. Maintenance runners will focus on external distractions when running at the moderate intensity because they are accustomed to this intensity level of exercise (Ericsson, 2003; Leventhal & Everhart, 1979; Rejeski, 1985).

2. Participants in the pre-contemplation/contemplation, preparation, and action stages will attend to bodily sensations when exercising at the very hard intensity (90% HR_{max}). Running at a very hard intensity will demand their attention due to its difficulty and subsequent increase in heart rate, breathing rate, muscle fatigue, and body in general as they run at this level of intensity (Brewer, Van Raalte, & Linder, 1996; Goode, 1996; Hutchinson & Tenenbaum, 2007; Leventhal & Everhart, 1979; Rejeski, 1985; Tammen, 1996; Tenenbaum, 2001). Maintenance stage participants will focus on external distractions at the very hard intensity again because they are accustomed to this intensity and will not feel exerted enough for their attention to be forced to bodily sensations (Ericsson, 2003; Leventhal & Everhart, 1979; Rejeski, 1985).

Table 3

Hypothesized Relationships between Exercise Intensity and Attentional Focus

Stages of Change	Moderate Intensity (65% HR_{max})	Very hard Intensity (90% HR_{max})
Pre-Cont./Contemplation	External Distractions	Bodily Sensations
Preparation	?	Bodily Sensations
Action	?	Bodily Sensations
Maintenance	External Distractions	External Distractions

Practical importance

Every runner benefits from a specific type of attentional focus, depending on his or her level of experience. Optimal cognitive strategy will not only enhance performance, but it can also serve to decrease perceptions of pain that result from running, as well as enhance enjoyment of the exercise itself. This is important for beginner runners because the proper cognitive strategy will increase the possibility that they will adhere to an exercise routine once they have begun. The current study has conceptual importance regarding more experienced runners because it will examine their attentional focus use as a function of varying intensities. The literature states that experienced runners use a task-relevant focus to enhance performance. The literature does not address the question of whether they focus on task-relevant information due to the high intensity levels during typical exercise bouts (i.e., it forces their attention to task-relevant information), or whether this type of focus is intentional and used as a strategy, hence leading to an increase in exercise intensity. The current paper is the first to examine the effect of both expertise and intensity of exercise on attentional focus.

Methods

Participants

One hundred and forty-five Western Kentucky University students (42 males, 103 females) with a mean age of 18.94 (*SD*=1.78) and mean BMI of 22.71 participated in the study. The sample included Introductory Psychology students, as well as Western Kentucky University Cross-Country and Soccer team members. Introductory Psychology students participated as a course requirement or for extra credit. Members of the cross-country and soccer teams were compensated with a $15 gift certificate for their participation because they were not fulfilling a course requirement or receiving extra credit.

The sample was divided into differing levels of expertise based on the Stages of Change measure (Marcus et al., 1992). This measure asks participants to indicate which of the five statements [I currently do not exercise and do not intend to start exercising in the next 6 months; I currently do not exercise, but I am thinking about starting to exercise in the next 6 months; I currently exercise some, but not regularly (**regularly** is defined as exercising 3 or more times per week for at least 30 minutes per session); I currently exercise regularly; I have been exercising regularly for the past six months or longer] described them best. The pre-contemplation/contemplation, preparation, action, and some maintenance runners were derived from the student sample. The cross-country and soccer team participants (as well as students that qualified at this level) served as the maintenance runners sample. Very few participants met the criteria for the pre-contemplation and contemplation stages; therefore, the samples for these two stages were combined. The total number of participants in each category was as follows: pre-contemplation/contemplation (n=15), preparation (n=46), action (n=43), and maintenance (n=41). Refer to Table 4 for a complete list of demographic information broken down by Stages of Change.

To examine patterns in exercise behavior, participants in the preparation, action, and maintenance stages were asked how many days per week they exercise and average duration of their exercise bouts. As experience level increased, frequency of exercise also increased (preparation: *M*=2.47, *SD*=1.34; action: *M*=3.98, *SD*=2.23; maintenance: *M*=4.93, *SD*=1.99). This same pattern was found for average duration (in minutes) of exercise bouts (preparation: *M*=39.73, *SD*=24.04; action: *M*=50.77, *SD*=29.31; maintenance: *M*=68.00, *SD*=37.17). Reports of the average intensity level of endurance exercise were rated using Borg's Rating of Perceived Exertion scale (6= No exertion at all, 20= maximal exertion). The preparation stage reported exercising at an average intensity of 12.78 (*SD*=1.61), the action stage reported an average of 13.20 (*SD*=1.76), and the maintenance stage reported an average of 14.98 (*SD*=2.26). As level of experience increased, average RPE scores also increased. Participants who reported participating in interval training also reported average RPE scores; the same linear trend was found. The preparation stage reported exercising at an average of 14.14 (*SD*=1.46), the action stage reported an average of 14.38 (*SD*=2.98), and the maintenance stage reported an average of 16.38 (*SD*=2.55).

Participants in the preparation, action, and maintenance stages were asked what their primary purpose for engaging in exercise was. We chose to approach this analysis by separating the athletes (i.e., the cross-country and soccer team members) from the non-athletes. An average of 47.6% of the athletes reported that their main purpose in engaging in exercise was for competition, whereas 38.9% of the non-athletes reported that their main purpose was for fitness. Both the athletes and non-athletes followed up with 33.3% reporting their main purpose was for personal enjoyment.

Materials

Demographic information was collected to identify participants at the pre-contemplation/contemplation, preparation, action, or maintenance stage (Appendix A). They were asked about their best performance times from the past three months (one mile, 5k, and 10k), whether they routinely receive performance feedback (e.g., from a coach, themselves, or fellow athletes), frequency, and purpose of exercising. Participants were given a choice of a DVD to watch during the exercise bout and were asked in the questionnaire to rate how interested they were in the video at the end of the exercise session. They were able to choose from a variety of television shows popular with college students, such as Friends, National Geographic programs, and sports bloopers (Appendix B).

The Stages of Change measure (Marcus et al., 1992) was used to divide participants by level of experience. Participants were classified as fitting into one of the following stages: pre-contemplation/contemplation, preparation, action, and maintenance. As described, the pre-contemplation and contemplation stages were combined into one stage due to a lack of qualified students. This model has been shown to have high test-retest reliability (r=.78) and concurrent validity with the Seven Day Physical Activity Recall Questionnaire (Blair, 1984; Marcus & Simkin, 1993).

As previously mentioned, the Measure of Attentional Focus was used to assess participants' focus of attention during the exercise bouts (Appendix A). Stevinson and Biddle's (1998) model of attentional focus divided the categories into internal/external task-relevance and internal/external task-irrelevance. The current study uses these four categories but has added two additional categories. Internal task-relevance is separated into three sub-categories: "bodily sensations," "task relevant thoughts," and "self-talk." In their study, Morgan and Pollock (1977) reported that runners focused on bodily input, time, pace, other runners, and engaged in self-talk. Self-talk and thoughts related to the task are internal processes, yet they do not fit in with the bodily sensations included in the internal task-relevance category suggested by Stevinson and Biddle (1998). By separating Stevinson and Biddle's (1998) internal task-relevance category into three categories, it becomes exhaustive and allows for the collection of all types of internal task-relevant information on which an exerciser can focus. It is important to note that self-talk can be motivational ("I can do this!") or can be discouraging ("I feel tired, is this almost over?"). The external task-relevance category has been re-named "task-relevant external cues" and includes things that are related to the exercise but are external to the person, such as split-times and other competitors. The internal task-irrelevance category has been re-named "task-irrelevant thoughts" and includes things that are internal to the person but are unrelated to the exercise, such as daydreaming or thinking about memories. External task-irrelevance is now referred to as "external distractions" and includes things such as watching television or focusing on the environment.

In summary, there are six attentional focus categories in the current study: 1) Bodily sensations (e.g. heart rate, breathing); 2) Task-relevant thoughts (e.g., strategies, goals); 3) Self-talk (e.g., I can do this, I wish this was over); 4) Task-relevant external cues (e.g., split times, distance markers); 5) Task-irrelevant thoughts (e.g., daydreaming, planning); and 6) External distractions (e.g., music/TV, other people).

To ensure that the questions in the MAF would be interpreted correctly and that no problems would be encountered by participants, cognitive interviews were conducted. Five university and high school coaches and 9 adult athletes of varying expertise and sport (running, cycling, swimming) were asked to complete the MAF out-loud (referred to as "thinking aloud"). They were instructed to ask any questions and provide suggestions for how the measure could be improved. Upon completion, the interviewer then asked the participants to re-examine specific terms used throughout the MAF (e.g., How did you interpret the word "competition?"; How easy or difficult was question X to answer?). Finally, the participants were asked a set of speculation questions about the effects of attentional focus on endurance and performance. These interviews were digitally recorded, and two researchers listened to each interview and mutually agreed upon changes to be made to the measure.

After coding the participants' answers, results showed that six attentional focus categories were comprehensive and easily interpretable. New exemplars suggested by the participants were added to the categories, and a neutral point for the affective scales was added. Finally, many of the participants suggested moving the percentage estimates for each attentional focus category onto a single page and at the end of the questionnaire.

The MAF consists of questions for each of the six attentional focus categories. The participants were asked a group of questions for each category. For bodily sensations, for example, they were first asked whether they focused on bodily sensations by circling "yes" or "no." If they marked "yes," they next had to mark whether they interpreted their bodily sensations in a positive, negative, or neutral way. Next, they were told to imagine their exercise bout as if it were divided into three equal parts, and mark at which points (first, middle, last) they focused on their bodily sensations. Lastly, they were asked to report a number to represent about how many thoughts about bodily sensations they focused on and to provide some examples. The final page of the MAF instructed the participant to indicate what percentage of time they focused on each of the six categories. The six categories were listed individually, along with a 100-point scale that had 10-point increments. The participants were instructed to make sure that the total percentage added up to 100%. If participants' total scores were less than 90 or greater than 110, their data was not included in the results.

The interest/enjoyment subscale of the Intrinsic Motivation Inventory (IMI) (Ryan, 1982) was administered following each exercise bout. This measure includes four questions relating to interest and enjoyment in the task. Participants rated their responses on a 7-point Likert scale from (1) strongly disagree to (7) strongly agree. Scores can range from 4 to 28, with higher scores indicating greater enjoyment. The IMI has been found to have strong construct validity and this particular subscale has the greatest internal consistency (α=.92) (McAuley, Wraith, & Duncan, 1991).

A pain scale and Borg's Rating of Perceived Exertion (RPE) measure were administered following each exercise bout. The RPE scale ranges from 6 to 20; higher scores indicate greater ratings of exertion. A strong correlation between RPE and heart rate (r=.80-90) has been found, and the measure is considered to be reliable and valid

(Borg, 1982). The pain scale ranges from 0 to 11, with higher numbers indicating greater levels of pain.

BIOPAC© Systems, Inc. physiological equipment was used to record an electrocardiogram before, during, and after the bout of exercise. This required three electrodes to be attached to the torso.

Procedures

After greeting the participants, the experimenter directed them to complete the American College of Sports Medicine (ACSM; 2000) risk stratification questionnaire to determine whether they were eligible to participate in the study. The ACSM risk stratification assesses risk based upon seven risk factors (i.e. family history of heart disease, diabetes) and nine signs/symptoms (i.e., dizziness, difficulty breathing). Participants were instructed to mark yes or no for each risk factor and sign/symptom. They could only participate if they had marked yes for no more than one risk factor and no signs/symptoms. Also, males could not be over the age of 45 and females could not be over the age of 55 (Appendix C). Next, the participant was given an informed consent form to read and sign and was given a chance to ask any questions.

Participants next chose which DVD they wanted to watch while exercising. The DVD was viewed during both the moderate and very hard conditions in order to maintain consistency and ensure that the obtained results were due to the change in intensity and not a change in television program.

Next, participants were familiarized with the BIOPAC© Systems, Inc. physiological equipment, and the placement of three electrodes to the participants' torso. The electrodes were attached to the skin at least five minutes prior to beginning the recording to reduce noise in the measurement. Two electrodes were attached to the left and right lower ribcage, and the third electrode was placed on the right collarbone. Before each electrode was attached, the skin was prepared by lightly rubbing the skin with an abrading pad and swabbing a cotton ball of alcohol to remove any loose skin. This also reduced noise in the data recording. A questionnaire assessing demographics was administered, followed by a recording of the participants' height and weight. Immediately after the exercise bout on both days, a questionnaire assessing enjoyment, exertion, and pain was completed.

Once the participants completed the initial questionnaires, the electrode leads were attached and the equipment was calibrated. Participants were familiarized with the treadmill and the exercise began with a 2-minute warm-up period, followed by 15 minutes of running. During the 2-min warm-up, participants were asked to select the volume at which the DVD was played. Participants were assigned to run at a predetermined speed on the treadmill for 15 minutes on each day. One of the runs was set at a moderate intensity (65% of HR_{max}), and the other was at a very hard intensity (90% of HR_{max}). The selected DVD was turned on during the 15-minute bout.

The intensity levels were set at the beginning of the bout based on the calculation of each participant's percentage of heart rate maximum (% HR_{max}; 220-age). According to the ACSM, a moderate intensity is between 55-69% HR_{max}, and a very hard intensity is 90% HR_{max} or greater.

Heart rate was monitored using the BIOPAC© equipment, and the speed of the treadmill was gradually increased by .5 mph every 30 seconds until the participant's heart rate reached the assigned intensity.

Following both sessions, participants filled out the MAF. Before the participants left at the end of the second session, the psychology students were granted credit on the study board, and the cross-country and soccer team participants were compensated with a $15 WKU Bookstore gift card for their participation. The total duration of the study was approximately 60 minutes.

To enhance the generalization of the results, the laboratory was transformed so that it resembled a gym. Along with a television, large plants as well as motivational posters depicting scenes of running were added to the lab.

Design

A 2 (within) X 4 (between) design was implemented for the study. There were two levels of intensity (moderate and very hard) and four levels of expertise [pre-contemplation/contemplation, preparation, action, and maintenance]. Participants who reported that they were not currently engaging in any physical activity were identified as being in the pre-contemplation/contemplation stage. Those who indicated that they were engaging in physical activity, but not regularly (at least 3 days per week and 30 minutes per session), were classified as being in the preparation stage. Those who had been engaging in regular aerobic exercise for 6 months or less were identified as being in the action stage. Lastly, those who had been engaging in regular physical activity for at least 6 months were classified as being in the maintenance stage.

Results

Table 4 illustrates various dependent variables separated by the Stages of Change. As mentioned, the pre-contemplation/contemplation stage had a much smaller sample size (n=15) compared to the other three stages (n=46, 43, & 41). This was most likely due to non-exercisers feeling uncomfortable participating in an exercise study or having the false belief that we only wanted regular exercisers to participate in our study. There was also a much smaller sample of male participants (n=42) compared to females (n=103). This may be due to the fact that there are a greater number of female psychology students compared to male psychology students.

Differences in exertion ratings were not significantly different, but some trends were observable. The average RPE scores at the moderate intensity were similar for the preparation (M=10.65, SD=2.00) and action stages (M=10.80, SD=2.01), but were slightly higher for the pre-contemplation/contemplation stage (M=11.67, SD=2.79) and slightly lower for those in the maintenance stage (M=10.56, SD=2.20). The average RPE scores at the very hard intensity were the same across stages (approx. M=15, SD=2), but were slightly lower for those in the maintenance stage (M=14.80, SD=2.15).

The average speed (miles per hour) that the treadmill was set at during the moderate intensity increased linearly across the stages, with those in the pre-contemplation/contemplation stage having the slowest speed (M=3.92, SD=0.46) and those in the maintenance stage having the fastest speed (M=4.65, SD=0.77). At the very hard intensity, those in the pre-contemplation/contemplation (M=6.27, SD=0.69), preparation (M=6.38, SD=0.91), and action (M=6.86, SD=0.91) stages were set at a similar speed, while those in the maintenance stage (M=8.00, SD=1.41) were set at a faster speed.

Finally, Table 4 shows the average enjoyment ratings between the stages. At the moderate intensity, it can be seen that those in the pre-contemplation/contemplation (M=19.36, SD=4.67) and preparation (M=19.30, SD=4.40) stages enjoyed the exercise bout more than those in the action (M=18.00, SD=6.44) and maintenance (M=18.65, SD=4.58) stages. At the very hard intensity, all participants had similar enjoyment scores; all participants enjoyed this bout less compared to the moderate intensity bout.

Table 4

Descriptive Information of each Stage of Change Category

			Stage of Change		
Variable	Pre-Cont./Cont	Preparation	Action	Maintenance	Total/Avg.
Sample Size	15	46	43	41	145
Number of Males	2	9	13	18	42
Number of Females	13	37	30	23	103
Mean Age	18.73 (1.28)	18.83 (2.32)	18.74 (1.16)	19.34 (1.78)	18.94 (1.78)
Mean RPE at Moderate Intensity	11.67 (2.79)	10.65 (2.00)	10.80 (2.01)	9.78 (2.20)	10.56 (2.20)
Mean RPE at Very Hard Intensity	15.67 (2.02)	15.63 (1.97)	15.07 (2.45)	14.80 (2.15)	15.24 (2.18)
Mean Speed at Moderate Intensity (mph)	3.92 (0.46)	3.86 (0.48)	4.04 (0.61)	4.65 (0.77)	4.14 (0.69)
Mean Speed at Very Hard Intensity (mph)	6.27 (0.69)	6.38 (0.91)	6.86 (0.91)	8.00 (1.41)	6.97 (1.25)
Mean HR_{max} at Moderate Intensity	66.82 (2.83)	65.51 (3.32)	64.87 (2.72)	64.53 (4.52)	65.18 (3.53)
Mean HR_{max} at Very Hard Intensity	90.08 (0.93)	89.72 (0.93)	89.41 (0.83)	89.04 (0.93)	89.47 (0.95)
Mean Enjoyment at Moderate Intensity	19.36 (4.67)	19.30 (4.40)	18.00 (6.44)	18.65 (4.58)	18.76 (5.10)
Mean Enjoyment at Very Hard Intensity	15.79 (6.45)	15.59 (4.65)	15.67 (5.59)	15.95 (5.06)	15.73 (5.19)

Note. RPE=Rating of Perceived Exertion.

Induction of intensity

Main effects between the moderate and very hard intensity for RPE, pain, and HR were found, suggesting that the induction of intensity was successful (Table 5). Participants reported significantly (p=.0001) higher RPE scores during the very hard intensity (M=15.26, SD=2.17) compared to during the moderate intensity (M=10.55, SD=2.21). In addition, significantly (p=.0001) higher pain scores were reported during the very hard intensity (M=3.42, SD=2.48) compared to during the moderate intensity (M=0.72, SD=1.06). Participants' percentages of heart rate maximum were significantly (p=.0001) higher at the very hard intensity (M=89.47, SD=0.92) compared to at the moderate intensity (M=64.95, SD=2.92). A main effect for level of enjoyment was found; participants reported enjoying the exercise bout significantly (p=.0001) more during the moderate intensity (M=18.75, SD=5.12) compared to during the very hard intensity (M=15.75, SD=5.25).

Table 5

Main effects for intensity level and RPE, Pain, HR, and Enjoyment

Variable &	Intensity		Statistics		
Potential Range	Moderate	Very Hard	F	p	Partial η^2
RPE (6-20)	10.55 (2.21)	15.26 (2.17)	510.128	.0001	.782
Pain (0-11)	.72 (1.06)	3.42 (2.48)	185.158	.0001	.566
$\%HR_{max}$ (0-100)	64.95 (2.92)	89.47 (0.92)	12654.78	.0001	.990
Enjoyment (4-28)	18.75 (5.12)	15.75 (5.25)	44.53	.0001	.257

Note. RPE=Rating of Perceived Exertion.

Out of 145 participants, 73 quit the very hard intensity bout early. Analyses of average bout duration across the stages showed that as level of experience increased, participants ran for longer periods. Within the pre-contemplation/contemplation stage, ten out of fifteen participants quit early. The average running duration for all participants in this stage was 9.20 (*SD*=4.97) minutes. Twenty-nine out of 46 preparation stage participants quit the bout early; all participants in this stage ran an average of 9.86 (*SD*=4.69) minutes. In the action stage, 19 out of 43 participants quit early, and the overall average for all participants in this stage was 11.63 (*SD*=4.5) minutes. Lastly, 15 out of 41 maintenance stage participants quit early. The average duration for all participants in this stage was 11.94 (*SD*=4.37) minutes.

Reports of attention to each attentional focus category

Tables 6 (moderate intensity) and 7 (very hard intensity) illustrate the mean reports of percentage of time spent attending to each of the six attentional focus categories by Stages of Change as well as across all stages.

Clearly, the majority of attention was allocated to external distractions (i.e., the DVD) at both the moderate and very hard intensities. At the moderate intensity, the pre-contemplation/contemplation stage allocated more attention to bodily sensations (M=20.00, SD=21.04) compared to the other stages (preparation: M=11.96, SD=12.89; action: M=15.12, SD=16.09; maintenance: M=9.63, SD=9.90). At the very hard intensity, while external distractions continued to be the category receiving the most attention, bodily sensations received a greater allocation across all stages (pre-contemplation/contemplation: M=16.33, SD=16.09; preparation: M=23.48, SD=18.65; action: M=20.70, SD=16.96; maintenance: M=23.90, SD=18.42). Also, self-talk received greater attention at the very hard intensity across all stages. Interestingly, those in the pre-contemplation/contemplation (M=19.00, SD=18.54) and action (M=15.12, SD=12.98) stages engaged in self-talk more than those in the preparation stage

(M=10.33, SD=12.13) and maintenance (M=6.46, SD=7.44) stages. This finding will be discussed shortly.

Table 6

Mean Reported Percentages of Attending to Each AF Category: Moderate Intensity

AF Category	Pre-Cont./Cont.	Preparation	Action	Maintenance	Overall
BS	20.00 (21.04)	11.96 (12.89)	15.12 (16.09)	9.63 (9.90)	13.07 (14.41)
TRT	9.00 (8.06)	9.35 (9.64)	8.14 (8.24)	7.32 (7.08)	8.38 (8.35)
ST	8.33 (8.38)	4.35 (6.11)	7.56 (11.31)	4.63 (8.69)	5.79 (8.91)
TREC	10.00 (7.56)	15.22 (13.58)	10.00 (7.87)	15.24 (13.69)	13.14 (11.83)
TIT	14.00 (19.20)	11.85 (11.37)	15.70 (16.57)	11.46 (12.95)	13.10 (14.36)
ED	39.33 (23.44)	47.50 (18.82)	44.19 (22.17)	51.46 (23.43)	46.79 (21.78)

Note. BS=Bodily Sensations, TRT=Task-Relevant Thoughts, ST=Self-Talk, TREC=Task-Relevant External Cues, TIT=Task-Irrelevant Thoughts, ED=External Distractions.

Table 7

Mean Reported Percentages of Attending to Each AF Category: Very Hard Intensity

AF Category	Pre-Cont./Cont.	Preparation	Action	Maintenance	Overall Average
BS	16.33 (16.09)	23.48 (18.65)	20.70 (16.96)	23.90 (18.42)	22.03 (17.82)
TRT	11.00 (8.49)	9.67 (8.91)	10.47 (9.18)	11.22 (9.73)	10.48 (9.12)
ST	19.00 (18.54)	10.33 (12.13)	15.12 (12.98)	6.46 (7.44)	11.55 (12.70)
TREC	14.67 (11.25)	17.94 (16.18)	14.65 (12.60)	15.98 (12.90)	16.07 (13.73)
TIT	3.00 (5.28)	8.74 (15.81)	7.91 (11.46)	6.02 (8.57)	7.13 (11.94)
ED	36.00 (26.67)	29.24 (22.14)	31.40 (20.04)	36.34 (25.57)	32.59 (23.03)

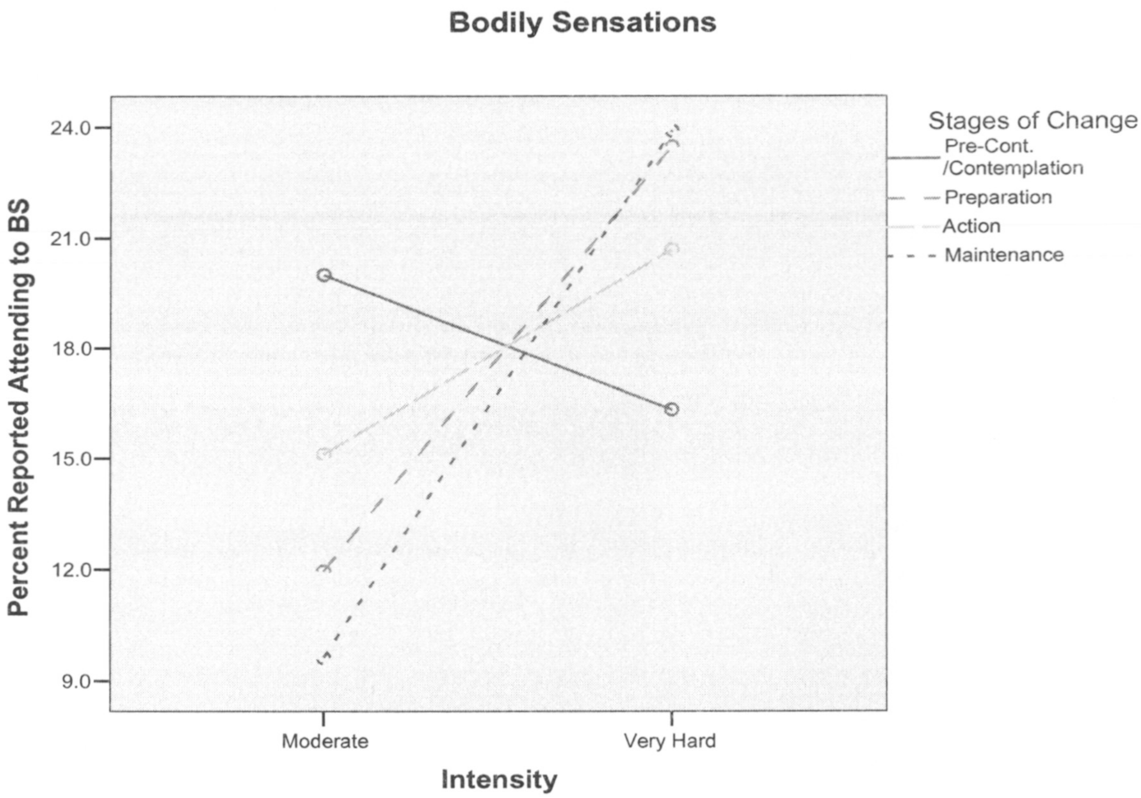
Note. BS=Bodily Sensations, TRT=Task-Relevant Thoughts, ST=Self-Talk, TREC=Task-Relevant External Cues, TIT=Task-Irrelevant Thoughts, ED=External Distractions.

Hypotheses and interaction

It had been predicted that those in the pre-contemplation/contemplation stage would primarily focus on external distractions (the DVD) at the moderate intensity bout. According to the Parallel Processing Model (PPM) and research by Rejeski (1985), people unaccustomed to exercise will focus their attention away from feelings of exertion. It was also predicted that these participants would be forced to focus on their bodily sensations at the very hard intensity because their focal awareness would be dominated by the feelings of exertion resulting from the exercise. No hypotheses were stated for what type of focus those in the preparation and action stages would have during the moderate intensity bout, but it was predicted that they would primarily focus on their bodily sensations during the very hard intensity (again, based off of the PPM). Finally, it was predicted that those in the maintenance stage would focus on external distractions (the DVD) at both intensities because the exercise was not strenuous enough to force their attention inwardly to their bodily sensations. The participants in this stage are accustomed to exercising at both moderate and very hard intensities for longer periods than the current study required. As previously stated, this stage reported typically exercising at an RPE of 14.98 (*SD*=2.26); a rating of 15 on Borg's RPE scale represents a "hard (heavy)" intensity.

An interaction was found between Stages of Change and percentage of time reported focusing on bodily sensations across intensities (Figure 1). It had been hypothesized that all stages (with the exception of the maintenance stage) would primarily focus on bodily sensations at the very hard intensity; this was not supported. All stages placed the greatest amount of attention on external distractions; however, all stages (with the exception of the pre-contemplation/contemplation stage) did focus on bodily sensations significantly more as intensity increased. The pre-contemplation/contemplation stage actually focused on bodily sensations less at the very hard intensity compared to at the moderate intensity. Out of the fifteen participants in this stage, ten quit the very hard intensity bout after an average of about 9 minutes. It is possible that the 2/3rds of participants in this stage that dropped out quit the bout as soon as they began experiencing feelings of discomfort, thus truncating their percentage estimations for amount of time spent focusing on bodily sensations. Had they continued to run and endured the physical discomfort, they would have possibly reported focusing on their bodily sensations for a greater amount of time and it could have become their primary focus. As the Parallel Processing Model suggests, there is a difference between perception and focal awareness. The theory states that, as intensity increases, perceptions of exertion filter through attentional channels and enter into focal awareness. The participants in the pre-contemplation/contemplation stage apparently were not willing to endure an exercise bout where bodily sensations dominate focal awareness as compared to participants in higher stages. This makes sense, as persons in higher stages are more accustomed to exercising at higher intensities.

Figure 1



Main effects across stages for attentional focus

A main effect for self-talk and Stages of Change was found (Table 8). Self-talk was used significantly more during both intensities by participants in the pre-contemplation/contemplation (M=13.67, SD=7.98) and action (M=11.34, SD=8.00) stages compared to the preparation (M=7.34, SD=8.00) and maintenance (M=5.55, SD=8.00) stages.

Table 8

Main Effect for Stages of Change and Self-Talk

Stages of Change	% Reported Attending to Self-Talk
Pre-Cont./Contemplation	13.67 (7.98)
Preparation	7.34 (8.00)
Action	11.34 (8.00)
Maintenance	5.55 (8.00)

Note. F= 6.07, p = .001, partial η^2 = .114.

Main effects between intensities for attentional focus

A main effect for intensity level and five of the six attentional focus categories was found (Table 9). As intensity level increased, participants' focused significantly more on bodily sensations, self-talk, and task-relevant external cues, and they focused significantly less on task-irrelevant thoughts and external distractions.

Table 9

Main Effects for Intensity Level and Five of the Six Attentional Focus Categories

AF Category	Intensity		Statistics		
	Moderate	Very Hard	F	p	Partial η^2
BS	13.07 (14.41)	22.03 (17.82)	12.33	.001	.080
ST	5.79 (8.91)	11.55 (12.70)	25.47	.0001	.153
TREC	13.14 (11.83)	16.07 (!3.73)	4.84	.029	.033
TIT	13.10 (14.36)	7.13 (11.94)	23.17	.0001	.141
ED	46.79 (21.78)	32.59 (23.03)	32.12	.0001	.186

Note. BS=Bodily Sensations, TRT=Task-Relevant Thoughts, ST=Self-Talk, TREC=Task-Relevant External Cues, TIT=Task-Irrelevant Thoughts, ED=External Distractions.

Post-hoc analyses of attentional focus use between Stages of Change

Bonferroni post-hoc analyses found a significant (p=0.015) difference for the time spent focusing on bodily sensations between the pre-contemplation/contemplation (M=20.00, SD=21.04) and maintenance (M=9.63, SD=9.90) stages at the moderate intensity (Table 10). Even at a moderate intensity, those in the pre-contemplation/contemplation stage spent 20% of their time focusing on their bodily sensations, and the majority reported interpreting them in a negative way (46.2%). This is most likely due to being unaccustomed to the physiological sensations elicited by the exercise. Those in the maintenance stage are used to the exercise and therefore did not spend as much time focusing on their bodily sensations; the majority rated interpreting them as neutral (61.5%).

A significant difference was found in the percentage of time spent focusing on self-talk between these two stages at the very hard intensity (Table 11). Those in the pre-contemplation/contemplation stage (M=19.00, SD=18.54) focused on self-talk significantly (p=0.001) more compared to those in the maintenance stage (M=6.46, SD=7.44). Within the pre-contemplation/contemplation stage, 58.3% reported that they interpreted their self-talk in a positive way. The examples of what types of self-talk they engaged in included "Almost done" "I wish this was over," and "I can do this." Within the maintenance stage, 66.7% interpreted their self-talk as positive. Examples of self-talk that the maintenance stage reported focusing on included "I can do this" and "I wish this was over." Although there is not a difference in the content of self-talk use between the two stages (both groups mainly engaged in positive self-talk), those in the pre-contemplation/contemplation stage engaged in it much more often in order to encourage themselves and cope with the high level of exertion. The maintenance participants are more accustomed to the exertion resulting from the exercise, and perhaps do not need to engage in self-talk as often as the pre-contemplation/contemplation participants who are unaccustomed to the exercise. The maintenance participants may have relied on other methods that they routinely utilize when exercising at a very hard intensity, but because this exercise was set at a very hard intensity, they still spent a percentage of their time engaging in positive self-talk to make it through the bout.

Reports of attending to self-talk at both the moderate and very hard intensities were significantly (p=0.051, p=0.04; respectively) different between the pre-contemplation/contemplation and preparation stages (Tables 11 & 12). At the moderate intensity, those in the pre-contemplation/contemplation stage reported attending to self-talk significantly more (M=8.33, SD=8.38) than those in the preparation stage (M=4.35, SD=6.11). The majority of the pre-contemplation/contemplation participants reported that they interpreted self-talk in a neutral way (60%), while an equal number of participants in the preparation stage interpreted it in a neutral (43.8%) or positive way (43.8%). The pre-contemplation/contemplation participants were not exerted enough to require the use of positive self-talk, and, for the same reason, perhaps they did not need to engage in very much negative self-talk. This same trend occurred at the very hard intensity; those in the pre-contemplation/contemplation stage focused on self-talk significantly more (M=19.00, SD=18.54) than those in the preparation stage (M=10.33, SD=12.13). This time, the majority of both stages reported interpreting self-talk in a positive way (pre-contemplation/contemplation: 58.3%; preparation: 50%). Once again, those in the pre-contemplation/contemplation stage are unaccustomed to feelings of exertion and may have engaged in positive self-talk as a way to cope with the difficulty of the exercise. This same explanation can be applied to those in the preparation stage, as they do not exercise on a regular basis as well.

There was a significant difference (p=0.0001) in percentage of time spent focusing on self-talk between participants in the action (M=15.12, SD=12.98) and maintenance (*M*=6.46, *SD*=7.44) stages during the very hard intensity (Table 11). The majority of both stages interpreted their self-talk in a positive manner (action: 61.8%; maintenance: 66.7%). As stated above, those in the maintenance stage may not engage in self-talk as often because they have other methods that they are accustomed to using while exercising; however, although both of these stages participate in regular exercise, this was still a very hard intensity and both engaged a positive self-talk strategy.

The percentage of time spent focusing on task-relevant external cues during the moderate intensity was significantly higher for those in the preparation (*M*=15.22, *SD*=13.58) and maintenance stages (*M*=15.24, *SD*=13.69) (p=.031, p=.033, respectively) compared to the action stage (*M*=10.00, *SD*=7.87) (Table 13). As shown in Table 6, those in the action stage were paying more attention to task-irrelevant thoughts (*M*=15.70, *SD*=16.57) and bodily sensations (*M*=15.12, *SD*=16.09). Those in the action stage were not as concerned with keeping track of time, whereas those in the preparation and maintenance stages were. It is possible that those in the preparation stage wanted to keep track of how much time remained until the bout would end, and those in the maintenance stage kept track of time because it is a routine that they are used to doing. The data cannot distinguish between these two because the participants simply listed attending to the time display and amount of time that had elapsed, and the majority of both stages (80% each) reported interpreting this focus in a neutral way.

Table 10

Bodily Sensations at the Moderate Intensity

	Pre-Cont./Cont.	Preparation	Action	Maintenance
Pre-Cont./Cont.				*
Preparation				
Action				
Maintenance	*			

Note. Asterisk represents significant Bonferroni post-hoc analysis between stages.

Table 11

Self-Talk at the Very Hard Intensity

	Pre-Cont./Cont.	Preparation	Action	Maintenance
Pre-Cont./Cont.		*		*
Preparation	*			
Action				*
Maintenance	*		*	

Note. Asterisk represents significant Bonferroni post-hoc analysis between stages.

Table 12

Self-Talk at the Moderate Intensity

	Pre-Cont./Cont.	Preparation	Action	Maintenance
Pre-Cont./Cont.		*		
Preparation	*			
Action				
Maintenance				

Note. Asterisk represents significant Bonferroni post-hoc analysis between stages.

Table 13

Task-Relevant External Cues at the Very Hard Intensity

	Pre-Cont./Cont.	Preparation	Action	Maintenance
Pre-Cont./Cont.				
Preparation			*	
Action		*		
Maintenance				

Note. Asterisk represents significant Bonferroni post-hoc analysis between stages.

Old model analysis

To examine the benefits of the attentional focus measure used in this study, the data were combined to form the two classic attentional focus categories: association and dissociation. Total percentage of time reportedly spent focusing on bodily sensations, task-relevant thoughts, self-talk, and task-relevant external cues was combined to form a single association category, and total percentage of time reportedly spent focusing on task-irrelevant thoughts and external cues was combined to form a single dissociation category. Analyses produced no significant interactions between attentional focus and Stages of Change, but did produce a main effect for the effect of intensity level on attentional focus (Table 14). This is important because it supports the use of the new model of attentional focus; it is not only important to include Stevinson and Biddle's (1998) internal/external dimension, but by expanding the internal task-relevant category into bodily sensations, task-relevant thoughts, and self-talk it allows for differences in attentional focus between Stages of Change to be seen.

Table 14

Main Effects for Intensity Level and Classic "Association/Dissociation" Categories

Attentional	Intensity		Statistics		
Focus	Moderate	Very Hard	F	p	Partial η^2
Association	40.31 (22.61)	59.79 (24.07)	78.72	.0001	.357
Dissociation	59.90 (22.61)	40.06 (23.96)	81.74	.0001	.365

Discussion

Manipulation

It is important to show that the induction of each level of intensity was successful. The data collected for ratings of perceived exertion, pain, and percentage of heart rate maximum showed significant differences between each intensity, suggesting that the manipulation was successful. Not only were RPE scores higher for all participants at the very hard intensity than at the moderate intensity, but ratings of pain and average percentages of heart rate maximum also increased as intensity increased.

Hypotheses

The hypotheses of this study were partially supported. The hypothesis that those in the pre-contemplation/contemplation stage would focus the majority of their attention on external distractions (the DVD) at the moderate intensity was supported, while the prediction that they would focus primarily on their bodily sensations at the very hard intensity was not supported; bodily sensations ranked as second-highest in the percentage estimates of attention allocation to each of the categories. The participants in this stage are unaccustomed to high intensity exercise, and thus are more likely to quit as soon as they experience aversive feelings of exertion. It is possible that they did not endure the exercise for a long enough period of time for bodily sensations to enter focal awareness and thus dominate their attention. Therefore, their self-report of what they attended to may have reflected what they were attending to (i.e., the DVD) up until the time that they quit (i.e., as soon as bodily sensations began to enter focal awareness). Had they endured the physical discomfort and continued to run at the very hard intensity, they maybe would have reported a greater percentage of time spent focusing on bodily sensations. It is worthwhile noting that they did report an increase in attention to self-talk at the very hard intensity compared to the moderate intensity. Because the intensity was so high, they had to engage in a positive self-talk strategy to cope with the exertion. Although the results showed that they were not primarily focusing on their bodily sensations, it was obvious that the participants in this stage were physically uncomfortable exercising at the very hard intensity because ten participants quit after an average of about 9 minutes of running at this intensity.

No hypotheses were made regarding the preparation and action stages at the moderate intensity, but it was hypothesized that they would focus on bodily sensations at the very hard intensity; this hypothesis was not supported. The results showed that these two conditions focused the majority of their attention on external distractions, regardless of intensity.

It was predicted that the maintenance stage would focus on external distractions at both intensities, and this finding was supported. These participants exercise at moderate and very hard intensities on a regular basis and are used to feelings of exertion. Furthermore, the exercise bout in this study only lasted fifteen minutes, and these participants are accustomed to running for greater lengths of time at these intensities.

An interaction between Stages of Change and bodily sensations was found. With the exception of the pre-contemplation/contemplation stage, all stages focused significantly more on their bodily sensations at the very hard intensity compared to at the moderate intensity. As stated, it was expected that those in the pre-contemplation/contemplation stage would report focusing on their bodily sensations significantly more at the very hard intensity compared to the moderate intensity, but instead they focused the majority of their attention on external distractions regardless of change in intensity.

A main effect for self-talk and Stages of Change was found. The participants in the pre-contemplation/contemplation and action stages engaged in self-talk significantly more than the other stages at both intensities. Both stages engaged mainly in positive self-talk as a way to encourage themselves. Those in the preparation stage perhaps did not dislike the exercise enough or experience enough pain to engage in negative self-talk, but probably have not adopted a positive self-talk strategy because they are not regular exercisers. Those in the maintenance stage possibly did not engage in self-talk because the bout was not of a significant length for them.

Main effects for intensity level and each of the six attentional focus categories were found; no main effect was found for task-relevant thoughts. It was predicted that the increase in intensity would lead to an increased focus on bodily sensations and other task-relevant information and to a decreased focus on task-irrelevant information. This study showed that, regardless of skill level, when intensity was increased from moderate to very hard, focus on task-relevant information increased significantly and focus on task-irrelevant information decreased significantly. Because there was no significant difference between intensities in percentage of time spent focusing on task-relevant thoughts, this suggests that no matter how physically demanding exercise is, one still places a similar amount of focus on things such as goals or pace. It is interesting to note that, with the exception of the pre-contemplation/contemplation stage, participants at all stages attended to external distractions less at the very hard intensity compared to at the moderate intensity and devoted the majority of their attention to bodily sensations at the very hard intensity. Those in the pre-contemplation/contemplation stage attended to external distractions the majority of the time despite the change in intensity. The pre-contemplation/contemplation stage also paid attention to self-talk during both intensities more than the other Stages of Change.

When relating the findings from this study to the literature, it is important to keep in mind that previous studies did not simultaneously take into account level of expertise and intensity. The exercise bouts in the current study could be considered as training runs for those in the maintenance stage because they lasted only fifteen minutes and these participants are accustomed to exercising at very hard intensities. The literature states that experienced runners have a task-irrelevant focus during training runs, and the participants in the maintenance stage did attend to external distractions more so than any other attentional focus category (Masters & Lambert, 1989; Raglin & Hale, 2005; Rose, 1986; Sachs, 1984). The literature on novice runners does not take training versus competition into account, but states that novices focus on task-irrelevant information during exercise (Brewer & Van Raalte, 1996; Okwumabua et al., 1983). The current study's results show that those in the pre-contemplation/contemplation stage mainly focused on external distractions at both intensities, supporting past research.

The current findings also support the literature on the influence of intensity on attentional focus. Goode (1996), Tammen (1996), and Hutchinson and Tenenbaum (2007) were able to show that, as intensity increased from moderate to very hard, participants' focus on task-relevant information increased. Again, Hutchinson and Tenenbaum (2007) did not take expertise into account; however, the results from their study are similar to the current study's results in that an increase in intensity led to an increase in task-relevant focus for all Stages of Change but pre-contemplation/contemplation. All four of the stages reported focusing the majority of their attention on external distractions during both intensities, but it is noteworthy that the percentage of time spent focusing on external distractions decreased as intensity increased. As the exercise became more difficult, it became more difficult to focus on the DVD, and attention was forced toward bodily sensations.

This study's results can also be interpreted in terms of the Parallel Processing Model (PPM) and research by Rejeski (1985) and Brewer, Van Raalte, and Linder (1996). As intensity increased, participants' internal-task relevant focus increased significantly; they were forced to focus on their bodily sensations more than they had at the moderate intensity (with the exception of the pre-contemplation/contemplation stage). The participants in this study reported enjoying the exercise less and experiencing more pain at the very hard intensity compared to at the moderate intensity. This explains why the participants in the pre-contemplation/contemplation stage focused on external distractions regardless of intensity. They were attempting to distract themselves from the aversive feelings of exertion. Therefore, based on the theoretical research by Leventhal and Everhart (1979), Rejeski (1985), and Brewer, Van Raalte, and Linder (1996), people unaccustomed to feelings of exertion resulting from exercise should exercise at low to moderate intensities. They will adhere to exercising regularly if they are not experiencing aversive physical symptoms and will enjoy it more because they will be able to attend to external distractions.

This study utilized a new attentional focus measure that was developed by the researchers. The measure was based on that of Stevinson and Biddle (1998) but expanded the internal task-relevant category into three new categories. By dividing the classical attentional focus categories of association and dissociation into six separate categories, more substantial data were collected and significant findings were discovered that would not have been apparent with only two categories. Analyses using the classic "association" and "dissociation" categories failed to show the interaction between Stages of Change and bodily sensations that the analyses using the MAF found. Main effects were found between association and dissociation as a function of intensity; however, the MAF parsed these findings out and was able to show that only five of the six attentional focus categories had significant main effects. Had the classic categories been used instead of the MAF, the main effect for Stages of Change and self-talk also would have gone unnoticed. Finally, the MAF is an improvement over the classic categories because it allowed for a clarification of the quantitative data. For example, for self-talk it was advantageous to have the ability to read examples of self-talk used by each of the stages in order to view who utilized it for positive self-talk versus who ruminated over wanting to quit.

Limitations

A limitation of this study was that there were twice as many female participants compared to male participants; however, the results showed no gender effects when examining attentional focus. A second limitation was that percentage of heart rate maximum was used instead of heart rate reserve (HRR). HRR is a more accurate formula when determining the heart rate at which a participant should exercise. It ensures that they are exercising at the target intensity because it considers individual differences. However, there are advantages to utilizing the percentage of heart rate maximum formula. First, it is a much simpler calculation, and second, its simplicity gives it greater ecological validity than HRR because it is a formula that an exerciser can calculate quickly and easily, whereas HRR is not.

A potential limitation of the Measure of Attentional Focus (MAF) concerns the estimations of percentage of time spent attending to each of the six categories. Because participants are instructed to make sure that the sum of their total percentages across the six categories equals 100%, this causes the percentages listed for each category to be dependent upon one another. For example, if a participant gives bodily sensations a percentage of 40% and task-relevant thoughts a percentage of 30%, only 30% is left to divide among the other four categories. One suggestion for future research is to test the same participants under the same conditions but with two sets of instructions. One set would instruct participants to rate each category on a scale from 0-100% with no restrictions on the total sum and the second set would restrict the sum to 100%. This study would allow one to determine if the method used in the current study is creating a dependency among the six categories.

Another limitation was that 76 out of 145 participants quit the very hard intensity bout early at various times. Ideally, the participants should have completed both bouts; however, our goal was to induce a focus on bodily sensations at the very hard intensity, and this did occur for the majority of the participants (with the exception of the pre-contemplation/contemplation stage, as previously discussed). A final limitation is that participants may have focused the majority of their attention on the DVD due to demand characteristics. By allowing the participants to choose which DVD they watched, they may have been led to believe that the researchers wanted them to focus primarily on the DVD.

Implications

This study is significant because people that fit into the pre-contemplation/contemplation stage can apply these results to their personal exercise routine to promote adherence. People in this stage should not exercise at a very hard intensity because it is too difficult to maintain and is less enjoyable compared to exercising at a lighter intensity. Enjoyment is extremely important because it encourages adherence to an exercise routine. Based on the results of the current study, the participants focused a sizable portion of their attention on bodily sensations even at the moderate intensity. This leads to the second implication of this study: it is beneficial for pre-contemplation/contemplation participants to focus their attention on external distractions and not bodily sensations because it may enhance enjoyment and distract them from feelings of exertion and pain.

A third implication relates to maintenance level exercisers. The results showed that they enjoyed the very hard intensity bout less than the moderate intensity bout. This information is useful because it supports the idea that avid exercisers should be aware of their exercise routines in terms of how often they exercise at very high intensities. If they exercise at a high intensity too often, it is more likely that they will find it less enjoyable. Incorporating moderate intensity activity into their routines will eliminate this issue. An earlier question was posed regarding whether runners with a high level of experience adopt a task-relevant focus due to strategy, or whether the high intensities at which they exercise force them to attend this way. The current study shows that as intensity increased, their focus on bodily sensations increased significantly. While they may focus on bodily sensations as a method of strategy, this study also shows that intensity enhances this focus unwillingly.

Fourth, this study is important because it observed the influence of both experience level and exercise intensity on attentional focus. The Stages of Change model was used, which is a reliable model that has been well established to examine differences between differing levels of exercisers. This is an improvement upon past research that has utilized numerous terms to describe their participant samples according to expertise. It is important that consistent terminology be used throughout the literature to compare results across studies and draw conclusions.

Future research

Future research should examine the effects of assigning each of the six attentional focus categories to participants and observe differences for persons in different Stages of Change. It may also be beneficial to examine covariates such as participants' level of motivation or how much they identify themselves as an exerciser. The current study could be replicated using other modes of exercise, such as cycling, swimming, or rowing. Also, differences between age groups should be examined. Attentional focus use of high school level athletes may differ from college level or older adults.

As the current study showed, it is difficult to obtain a sufficient number of participants that fit into the pre-contemplation or contemplation stages. This may only be true for the current study's setting: a university. This problem can be remedied by going into the classrooms (i.e., Introductory Psychology) and introducing the study to the students while assuring them that it is important that non-exercisers also participate.

Future studies that use the MAF to measure attentional focus should incorporate a question that will allow for a clarification concerning the task-relevant external cues category. The current study was unable to distinguish how participants interpreted their focus on time. It would be beneficial when interpreting the amount of time spent focusing on time elapsed between the stages because either they could be attending to time to use it as a strategy or they could be attending to it in the hopes that the bout will be over soon. By adding a question to the MAF asking participants to clarify their thoughts about time, this problem would be eliminated.

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Appendix A

Use to rate intensit
6 No exertion at al
7
Extremely light (
8
9 Very light
10
11 Light
12
13 Somewhat hard
14
15 Hard (heavy)
16
17 Very hard
18
19 Extremely hard
20 Maximal exertic

1. Gender: female or male 2. Age: [ ]

3. Which of the following statements best describes you? Please read all 5 statements and then circle your response.
   a. I currently do not exercise and do not intend to start exercising in the next 6 months.
   b. I currently do not exercise, but I am thinking about starting to exercise in the next 6 months.
   c. I currently exercise some, but not regularly (**regularly** is defined as exercising 3 or more times per week for at least 30 minutes per session).
   d. I currently exercise regularly.
   e. I have been exercising regularly for the past six months or longer.

If you chose "a" or "b", skip to #13

4. Current primary activity/sport (circle one):
Walking Running Swimming Cycling Other ______________

5. Continuous years participating in activity/sport circled above: _____

6. How many times per week do you currently participate in the activity/sport? _____

7. Select your main purpose for participating in the activity (check one):
   ___ Personal enjoyment (for fun)
   ___ Appearance/weight management
   ___ Social reasons (to be with friends, to socialize)
   ___ Fitness/health (to be physically fit)
   ___ Competition/challenge (to improve or maximize performance)

8. Do you compete in races? Yes or No

9. Current characteristics of *endurance/continuous* training:
   Frequency (times per week) _____
   Duration (average of amount of **time per session**) _____
   Intensity (see scale to the right) _____

10. Do you engage in *interval* training (defined as multiple high intensity exercise bouts with brief rest periods or low intensity exercise between each bout)?

   Yes or No (if "No", skip to #11)

a) What are the current characteristics of interval training?
   Frequency (times per week) _____
   Duration (average of amount of **time per session**) _____
   Intensity (see scale to the right) _____

11. The following questions are about performance feedback.

a) What is the source of your performance feedback? (check all that apply)
___Yourself ___ A Coach ___ A Trainer ___A fellow athlete/friend

b) Which performance aspects do you receive feedback on? (check all that apply)
___Times ___Form/Technique ___Strategy ___Training methods

12. Best performances within the past 3 months if known:

Running: **1 mile** _______ minutes **5k** _______ minutes **10k** _______ minutes

13. Are you currently suffering from any injuries? Yes or No
14. Have you experienced any injury within the last 6 months (new or recurring)? Y or N
15. Have you experienced any highly stressful life events within the last 24 hours?Y or N

STOP

Please choose the answer which best describes how you feel. Use the following scale to answer each question:

	Strongly Disagree						Strongly Agree
1. I enjoyed walking/running on the treadmill.	1	2	3	4	5	6	7
2. Walking/Running on the treadmill was fun.	1	2	3	4	5	6	7
3. I think walking/running on the treadmill was boring.	1	2	3	4	5	6	7
4. I think walking/running on the treadmill was quite enjoyable.	1	2	3	4	5	6	7

STOP, for experimenter use only.

Height ______
Weight ______
PAR ______

Estimated speed for 65% HR_{max} ______
Resting HR ______
HR_{max} for 65% ______
HR_{max} speed for 65% ______
RPE at 20 min ______
Pain estimate ______

DVD selected: ______
DVD stopped: ______

You will now be asked questions about what you *thought about* while running/walking today. The questions are divided into six categories. The six categories are: 1) Bodily sensations   2) Task relevant thoughts   3) Self-talk 4) Task relevant external cues   5) Task irrelevant thoughts   6) External distractions

1) Did you focus on bodily sensations (for example, **heart rate, breathing rate, muscles, fatigue, pain, sweating, cramps**)?

___Yes ___ No (if "No", skip to #2)

a) Rate the majority of your thoughts about your bodily sensations using the following scale:

1	2	3
negative	neutral	positive

b) Imagine your run/walk being divided into three equal parts. During which parts did you focus on bodily sensations (check all that apply):

First third ____ Middle third ____ Last third ____

c) Indicate the number of different bodily sensations you focused on _____.

d) What are some examples of the bodily sensations you focused on?

2) Did you focus on task relevant thoughts (for example, **strategies, goals, pace, injury concerns, thoughts about time**)?

___Yes ___ No (if "No", skip to #3)

a) Rate the majority of your task relevant thoughts using the following scale:

1	2	3
negative	neutral	positive

b) Imagine your run/walk being divided into three equal parts. During which parts did you focus on task relevant thoughts (check all that apply):

First third ____ Middle third ____ Last third ____

c) Indicate the number of different task relevant thoughts you focused on _____.

d) What are some examples of the task relevant thoughts you focused on?

3) Did you use <u>self-talk</u> (psyching up, for example, "**I can do it**"; **OR** psyching down, for example, "**I wish this was over**")?

___Yes ___ No (if "No", skip to #4)

a) Rate the majority of your self-talk using the following scale:

1	2	3
negative	neutral	positive

b) Imagine your run/walk being divided into three equal parts. During which parts did you use self-talk (check all that apply):

First third ____ Middle third ____ Last third ____

c) Indicate the number of different self-talk statements you used _____.

d) What are some examples of the self-talk you used?

4) Did you focus on <u>task relevant external cues</u> (for example, **time elapsed, a time display, a speed display, listening to the treadmill, the electrode cords**)?

___Yes ___ No (if "No", skip to #5)

a) Rate the majority of your thoughts about task relevant external cues using the following scale:

1	2	3
negative	neutral	positive

b) Imagine your run/walk being divided into three equal parts. During which parts did you focus on task relevant external cues (check all that apply):

First third ____ Middle third ____ Last third ____

c) Indicate the number of different task relevant external cues you focused on _____.

d) What are some examples of the task relevant external cues you focused on?

5) Did you focus on <u>task **ir**relevant thoughts</u> (for example, **daydreaming, problem solving, planning, recalling memories, meditating**)?

___Yes ___ No (if "No", skip to #6)

a) Rate the majority of your task **ir**relevant thoughts using the following scale:

1	2	3
negative	neutral	positive

b) Imagine your run/walk being divided into three equal parts. During which parts did you focus on task **ir**relevant thoughts (check all that apply):

First third ____ Middle third ____ Last third ____

c) Indicate the number of different task **ir**relevant thoughts you focused on _____.

d) What are some examples of the task **ir**relevant thoughts you focused on?

6) Did you focus on <u>external distractions</u> (for example, **TV, the environment/scenery**)?

___Yes ___ No (if "No", skip 6a-d)

a) Rate the majority of your thoughts about external distractions using the following scale:

1	2	3
negative	neutral	positive

b) Imagine your run/walk being divided into three equal parts. During which parts did you focus on external distractions (check all that apply):

First third ____ Middle third ____ Last third ____

c) Indicate the number of different external distractions you focused on _____.

d) What are some examples of the external distractions you focused on?

e) Rate how interesting you found the DVD that was playing on the following scale:

1	2	3	4	5	6	7	8	9	10
Not interesting at all								Very interesting	

What percentage of the time did you focus on each of the six categories?

Note. The sum of the percentages across all six categories *must equal* 100%. If you checked "No" for a category then you should select "0" for the % of that category.

1) Bodily sensations (**heart rate, breathing rate, muscles, fatigue, pain, sweating, cramps**)?

0 10 20 30 40 50 60 70 80 90 100 ______

2) Task relevant thoughts (**strategies, goals, pace, injury concerns, thoughts about time**)?

0 10 20 30 40 50 60 70 80 90 100 ______

3) Self-talk (psyching up, for example, **"I can do it"**; **OR** psyching down, for example, **"I wish this was over"**)?

0 10 20 30 40 50 60 70 80 90 100 ______

4) Task relevant external cues (**time elapsed, a time display, a speed display, listening to the treadmill, the electrode cords**)?

0 10 20 30 40 50 60 70 80 90 100 ______

5) Task **ir**relevant thoughts (**daydreaming, problem solving, planning, recalling memories, meditating**)?

0 10 20 30 40 50 60 70 80 90 100 ______

6) External distractions (**TV, the environment/scenery**)?

0 10 20 30 40 50 60 70 80 90 100 ______

Please make sure percentages chosen for the 6 categories add up to 100%;
Total % =

If you attended to bodily sensations please indicate which best describes why (check one):

____ I intentionally focused on or monitored my bodily sensations; OR
____My bodily sensations were so intense that my attention was drawn to them

Session #2

1. Are you currently suffering from any injuries? Y or N
2. Have you experienced any highly stressful life events within the last 24 hours? Y or N

STOP

Please choose the answer which best describes how you feel. Use the following scale to answer each question:

	Strongly Disagree						Strongly Agree
5. I enjoyed walking/running on the treadmill.	1	2	3	4	5	6	7
6. Walking/Running on the treadmill was fun.	1	2	3	4	5	6	7
7. I think walking/running on the treadmill was boring.	1	2	3	4	5	6	7
8. I think walking/running on the treadmill was quite enjoyable.	1	2	3	4	5	6	7

Please note any additional feelings or comments you have about the exercise bout below.

For experimenter use only:

Estimated speed for 90% HR_{max} ______

HR_{max} for 90% ______

HR_{max} speed for 90% ______

RPE at 20 min ______

Pain estimate ______

You will now be asked questions about what you *thought about* while running/walking today. The questions are divided into six categories. The six categories are:

1) Bodily sensations | 2) Task relevant thoughts | 3) Self-talk

4) Task relevant external cues | 5) Task irrelevant thoughts | 6) External distractions

1) Did you focus on bodily sensations (for example, **heart rate, breathing rate, muscles, fatigue, pain, sweating, cramps**)?

___Yes ___ No (if "No", skip to #2)

a) Rate the majority of your thoughts about your bodily sensations using the following scale:

1	2	3
negative	neutral	positive

b) Imagine your run/walk being divided into three equal parts. During which parts did you focus on bodily sensations (check all that apply):

First third ____ Middle third ____ Last third ____

c) Indicate the number of different bodily sensations you focused on _____.

d) What are some examples of the bodily sensations you focused on?

2) Did you focus on task relevant thoughts (for example, **strategies, goals, pace, injury concerns, thoughts about time**)?

___Yes ___ No (if "No", skip to #3)

a) Rate the majority of your task relevant thoughts using the following scale:

1	2	3
negative	neutral	positive

b) Imagine your run/walk being divided into three equal parts. During which parts did you focus on task relevant thoughts (check all that apply):

First third ____ Middle third ____ Last third ____

c) Indicate the number of different task relevant thoughts you focused on _____.

d) What are some examples of the task relevant thoughts you focused on?

3) Did you use <u>self-talk</u> (psyching up, for example, "**I can do it**"; **OR** psyching down, for example, "**I wish this was over**")?

___Yes ___ No (if "No", skip to #4)

a) Rate the majority of your self-talk using the following scale:

1	2	3
negative	neutral	positive

b) Imagine your run/walk being divided into three equal parts. During which parts did you use self-talk (check all that apply):

First third ____ Middle third ____ Last third ____

c) Indicate the number of different self-talk statements you used _____.

d) What are some examples of the self-talk you used?

4) Did you focus on <u>task relevant external cues</u> (for example, **time elapsed, a time display, a speed display, listening to the treadmill, the electrode cords**)?

___Yes ___ No (if "No", skip to #5)

a) Rate the majority of your thoughts about task relevant external cues using the following scale:

1	2	3
negative	neutral	positive

b) Imagine your run/walk being divided into three equal parts. During which parts did you focus on task relevant external cues (check all that apply):

First third ____ Middle third ____ Last third ____

c) Indicate the number of different task relevant external cues you focused on _____.

d) What are some examples of the task relevant external cues you focused on?

5) Did you focus on task **ir**relevant thoughts (for example, **daydreaming, problem solving, planning, recalling memories, meditating**)?

___Yes ___ No (if "No", skip to #6)

a) Rate the majority of your task **ir**relevant thoughts using the following scale:

1	2	3
negative	neutral	positive

b) Imagine your run/walk being divided into three equal parts. During which parts did you focus on task **ir**relevant thoughts (check all that apply):

First third ____ Middle third ____ Last third ____

c) Indicate the number of different task **ir**relevant thoughts you focused on _____.

d) What are some examples of the task **ir**relevant thoughts you focused on?

6) Did you focus on external distractions (for example, **TV, the environment/scenery**)?

___Yes ___ No (if "No", skip 6a-d)

a) Rate the majority of your thoughts about external distractions using the following scale:

1	2	3
negative	neutral	positive

b) Imagine your run/walk being divided into three equal parts. During which parts did you focus on external distractions (check all that apply):

First third ____ Middle third ____ Last third ____

c) Indicate the number of different external distractions you focused on _____.

d) What are some examples of the external distractions you focused on?

e) Rate how interesting you found the DVD that was playing on the following scale:

1	2	3	4	5	6	7	8	9	10
Not interesting at all								Very interesting	

What percentage of the time did you focus on each of the six categories?

Note. The sum of the percentages across all six categories *must equal* 100%. If you checked "No" for a category then you should select "0" for the % of that category.

1) Bodily sensations (**heart rate, breathing rate, muscles, fatigue, pain, sweating, cramps**)?

0 10 20 30 40 50 60 70 80 90 100 ______

2) Task relevant thoughts (**strategies, goals, pace, injury concerns, thoughts about time**)?

0 10 20 30 40 50 60 70 80 90 100 ______

3) Self-talk (psyching up, for example, "**I can do it**"; **OR** psyching down, for example, "**I wish this was over**")?

0 10 20 30 40 50 60 70 80 90 100 ______

4) Task relevant external cues (**time elapsed, a time display, a speed display, listening to the treadmill, the electrode cords**)?

0 10 20 30 40 50 60 70 80 90 100 ______

5) Task **ir**relevant thoughts (**daydreaming, problem solving, planning, recalling memories, meditating**)?

0 10 20 30 40 50 60 70 80 90 100 ______

6) External distractions (**TV, the environment/scenery**)?

0 10 20 30 40 50 60 70 80 90 100 ______

Please make sure percentages chosen for the 6 categories add up to 100%;
Total % =

If you attended to bodily sensations please indicate which best describes why (check one):
_____ I intentionally focused on or monitored my bodily sensations; OR
_____My bodily sensations were so intense that my attention was drawn to them

Appendix B

DVDs

1. 30 Years of National Geographic Specials
2. America's Funniest Home Videos: AFV Looks at Kids & Animals
3. National Geographic: Predators at War
4. SNL: The Best Of Will Ferrell
5. NOVA: Secrets of Lost Empires
6. Hidden Treasures: Europe to the Max
7. Amazing Sports Bloopers
8. The Best of Friends: Season 3
9. The Best of the Three Stooges
10. America Heart and Soul

Appendix C

ACSM Risk Stratification (ACSM, 2000)

Name Date: / / Gender: Female or Male Age:

Do you have any of the following conditions?

_________ 1. Family history of Heart disease: Heart attack, heart surgery, or sudden death before age 55 (father/brother/son) or 65 (mother/sister/daughter)

_________ 2. Cigarette Smoker: current or have quit within the past 6 months

_________ 3. High Blood Pressure: SBP $\geq$ 140 or DBP $\geq$ 90 (confirmed on 2 occasions or on Blood Pressure medication)

_________ 4. High cholesterol: total >200 (or HDL < 35, or > 130, or on medication for high cholesterol)

_________ 5. Diabetes (adult or juvenile) or Glucose Intolerance

_________ 6. Obesity (Body Mass Index $\geq$ 30, or waist circumference > 39 inches)

_________ 7. Sedentary Lifestyle (less than 30 minutes total "physical activity" most days)

Total risk factors =

Do you have any of the following?

_____ Pain, discomfort, tightness, or heaviness in the chest, neck, jaw, arms, or other areas
_____ Shortness of breath at rest or with mild exertion
_____ Dizziness or loss of consciousness
_____ Difficulty breathing when lying down or any difficulty breathing during physical exertion
_____ Swelling at the ankles
_____ Irregular or fast heart rate
_____ Intermittent leg pain or limping especially upon exertion
_____ Known heart murmur
_____ Unusual fatigue or shortness of breath with usual activities

Total signs/symptoms =

Stratification (only persons considered as ***low risk*** *may participate in this study)*

Low Risk	Younger individuals (males: younger than 45, females: younger than 55) who have no signs/symptoms and no more than 1 risk factor.
Moderate Risk	Older individuals (males: 45 and older, females: 55 and older) or those who have 2 or more risk factors.
High Risk	Individuals with 1 or more signs/symptoms or known cardiovascular, pulmonary or metabolic disease.